LIFE HEALTH AND VITALITY


Life ~ Health ~
Love ~ Happiness ~
Success

HEALTH

THE STANDARD MEDICAL INSTRUCTOR

FOR THE PEOPLE

Concerning LIFE, HEALTH *and* VITALITY

The WONDERFUL STRUCTURE *of the* HUMAN BODY

THE SIZE, SHAPE AND SITUATION OF THE VARIOUS ORGANS, DESCRIBING THE USES AND FUNCTIONS OF THE ORGANS AND THE WAY IN WHICH THEY DO THEIR WORK

HOW TO CONQUER DISEASE

THE NURSING AND TREATMENT OF SURGICAL DISEASES—MEDICAL DISEASES—PREVENTION AND CARE OF CONTAGIOUS AND OTHER DISEASES

DISEASES *of* WOMEN

SEX LIFE—SEX HYGIENE—SOCIAL EVIL—EUGENICS
MARRIAGE—THE EXPECTANT MOTHER—CHILD-BIRTH

CHILD WELFARE

BABYHOOD—CHILDHOOD—CHILDREN'S DISEASES
THE CARE AND TRAINING OF CHILDREN

The CARE *and* MANAGEMENT *of the* SICK

WHAT TO DO IN ACCIDENTS AND EMERGENCIES
THE JUDICIOUS USE OF MEDICINE

REGISTER *of* USEFUL PRESCRIPTIONS

and a

DICTIONARY *of* MEDICAL TERMS

Arranged so as to Bring the Subjects within the Understanding of the People of our Home Life

By

Professor D. G. REVELL, B. A. and M. D.

Former FACULTY MEMBER RUSH MEDICAL COLLEGE AND THE UNIVERSITY OF CHICAGO
ASSISTED BY AN ABLE STAFF OF PHYSICIANS

Published in Two Volumes

THE MEDICAL PUBLISHING COMPANY
CHICAGO, ILLINOIS U. S. A.

NOTE.—In the Artistic and Mechanical Execution of this Work, the Professional Services, Aid and Advice of the following well-known Artists, Engravers, Typesetters, Paper Manufacturers, Printers and Binders Contributed to Its Successful Completion.

Title Page designed by Leslie Christine Johnson.
Photographs by Official Photographers of
The Art Institute, Chicago,
Underwood and Underwood,
International Film Service,
Chicago Studio.
Cover Design by Comet Engraving Company.
Embossing on Cover by David J. Molloy Company.

Colortype Plates Engraved and Copyrighted by Manz Engraving Company.

Special Drawings and Engravings by Chicago Engravers Studio.
Half-tone Engravings by Globe Engraving Company.

Text Typesetting by Peterson Linotyping Company.
Display Type by Superior Typesetting Company.
Electrotyping by Globe Engraving Company.

Paper made Especially for this Work by Chicago Paper Company.

Printing by Homewood Press of Chicago.
Binding by The Robert O. Law Company.

PUBLISHERS NOTE

HEALTH — THE STANDARD MEDICAL INSTRUCTOR FOR THE PEOPLE on Life, Health and Vitality, fills the place hitherto left vacant between the uninformed public and the medical profession.

The instructions presented herewith contain much information that has long been desired by the people.

It has been recognized by the profession for many years that mankind was in a large degree responsible for his bodily ailments and also realized that sickness was man's punishment for breaking some natural law—laws not generally known or understood by the public.

The world is changing rapidly, the people are awakening to a sense of their responsibility for the care of their own bodies upon which depends their success and happiness in life.

The increasing demand and determination of the people to become better acquainted with the general principles of the laws of health and the knowledge of right living is evidenced on every hand.

The author has carefully considered the needs of the people of our home life and has prepared this SERIES OF INSTRUCTIONS for their use in such a convenient way (with Subject References) as to bring the information within the reach of all.

The conception involves not merely efforts to relieve human suffering but to prevent it—not alone the suffering of an individual or one community but an attempt to arouse all the people of the nation to a sense of responsibility for the welfare of their fellow beings.

To teach simplicity in all the habits of life, the prevention of disease, the necessary treatment for those who suffer and require immediate aid, to formulate the laws of health and to educate the public in the understanding and application of them has been the inspiring motive.

Whatever the condition of life, health may fail and the most careful are subject to sudden sickness and accidents; and even where aid is near at hand, it is best to be instructed in emergency medicine, as many occasions arise when a fundamental knowledge of the treatment and care of various diseases and accidents might save a life.

This work, written by a medical authority for the people, gives valuable advice for the care and management of the sick and prescribes the necessary remedial medicine for the treatment of disease and other helpful measures for the restoration of health and vigor. It teaches how to detect the approach of dangerous sickness and instructs in healing with and without medicine.

To instruct young people for the duties of parenthood and teach them clean living and high thinking is the educational need of the present generation if we are to solve the problems of ignorance regarding the sacredness of their bodies.

The most sacred of all life, human life, depends on the home teachings of personal purity and sex hygiene.

Children should be properly instructed by parents as to the truths and facts about sex laws and hygiene at as early an age as their intelligence will permit by gradually imparting to them the necessary knowledge in a tactful and delicate way (See Vol. 2, pages 302-306).

The silence and secrecy of parents in the past is now condemned as fathers, mothers, teachers and physicians realize the folly of withholding the life-knowledge necessary to the moral, mental and physical well-being of their off-spring.

In order to elucidate and bring out the various subjects in a more popular and simplified form, the publishers have caused the headings of each department to be written in such language as to bring them within the understanding and appreciation of the people who constitute our home life.

To impart the knowledge of how to live in order to maintain robust health and vitality and a highly developed body and mind is a life accomplishment upon which the author and his able staff of assistants may well be congratulated.

STRICTLY ETHICAL

NOTE: THE CONTENTS OF THIS WORK AND "THE INSTRUCTIONS" GIVEN ARE STRICTLY ETHICAL AND SUCH AS EVERY GOOD PHYSICIAN AND SURGEON DESIRES TO SEE IN THE POSSESSION OF HIS PATIENTS SO THAT THEY MAY INTELLIGENTLY FOLLOW HIS PRESCRIBED RULES.

THESE INSTRUCTIONS SHOULD FORM A PART OF THE EDUCATION OF ALL.

IGNORANCE OF THE STRUCTURE AND FUNCTIONS OF THEIR OWN BODIES, OF THE REQUIREMENTS OF THEIR OWN CONSTITUTIONS AND OF THE TRUE PRINCIPLES ON WHICH SOUND HEALTH IS TO BE PRESERVED, MUST BE OVERCOME BY PLACING THE NECESSARY KNOWLEDGE BEFORE THE PEOPLE IN THE FORM OF SPECIAL INSTRUCTIONS.

THE EXTENSIVE DIFFUSION OF SUCH KNOWLEDGE CAN AND WILL PUT AN END TO PREVAILING IGNORANCE.

KEY TO INSTRUCTIONS—**VOLUME 1**

For Further Reference Consult Index Pages 657 to 668

PART ONE—ANATOMY AND PHYSIOLOGY
Seventy-two Pages, 1 to 72

The Wonderful Structure of the Human Body

The Size, Shape and Situation of the Various Organs Describing the Uses and Functions of the Organs and the Way in Which They Do Their Work.

INSTRUCTION ONE
The Human Body
Ten Pages, 1 to 10

The General Structure of the Human Body

How It Is Built Up of Cells Consisting of HEAD (Skull and Face), which is Connected by the Neck to THE TRUNK, which is Divided into Two Cavities: The Thorax, or Chest; and, the Abdominal Cavity.

INSTRUCTION TWO
Skeleton, Muscles, Etc.
Fifteen Pages, 10 to 24

Description of the Skeleton

The Muscles and Soft Part Covering Skeleton.

INSTRUCTION THREE
Circulation and Respiration
Twenty Pages, 25 to 44

How the Heart Pumps the Blood Through the Arteries

The Veins Collect the Blood and Carry it Back to the Heart. Then it is Purified by the Lungs.

When We Take Air Into the Lungs Oxygen Passes Into the Blood.

Then Poisonous Gas and Animal Poisons Are Given Off by the Lungs.

INSTRUCTION FOUR
Digestion and Excretion
Eleven Pages, 45 to 55

The Organs of Digestion and Excretion

How the Human Engine Produces Heat, Energy and Force.

INSTRUCTION FIVE
Nervous System—Sensory Organs.
Seventen Pages, 56 to 72

Structure, Uses and Functions of the Nervous System and the Organs of Sense

FEELING—TASTING—SMELLING—HEARING—SEEING.

How the Nerves Regulate and Control the Body, Conveying Impulses Like Telegraph Wires to the Brain, Bringing All Parts of the Body into Harmonious Unity and Placing the Body in Communication with Its Surroundings.

PART TWO—HYGIENE
Two Hundred and Forty-Five Pages, 73 to 317

The Art of Preserving and Restoring Health Without Recourse to Medicine

How to Maintain Vigorous Health, Avoiding Violation of the Laws of Nature.

INSTRUCTION SIX
Ignorance Cause of All Disease.
Four Pages, 73 to 76

Disease Due to Ignorance

Human Welfare — Simple Instructions in Proper Care and Use of the Body.

INSTRUCTION FIFTEEN
Eye Glasses
Twelve Pages, 267 to 278

Effect of Spectacles and Eye-Glasses on the Health

HOW TO BUY AND HOW TO WEAR.

INSTRUCTION SIXTEEN
The Ear.
Eighteen Pages, 279 to 296

THE EAR AND ITS CARE

How to Avoid Injuries and Affections—Tests for Hearing.

INSTRUCTION SEVENTEEN
Household Hygiene.
Twenty-one Pages, 297 to 317

How to Maintain Healthful Conditions About the Home

Important Matters in Home Life Affecting General Health.

The Location and Construction of Home. Ventilation, Heating, Lighting, Pure Water Supply, Plumbing, Drainage, Garbage and Ashes.

PART THREE—DIETETIC GUIDE

Eighty-Six Pages, 318 to 403

LIFE GIVING—BODY BUILDING FOODS

A Factor in Disease and Health.

Special Diets for Obesity, Diabetes, Gout, Gravel, Rheumatism, Scurvy, Scrofula, Consumption, Anemia, Nervous Prostration, Neurasthenia, Fevers, Dyspepsia, Biliousness, Torpid Liver, Diarrhea, Constipation, Bright's Disease, Heart Disease, Bronchitis and Asthma.

INSTRUCTION EIGHTEEN
Introductory.
Thirty-one Pages, 318 to 348

A Practical Guide for Invalids in Food Problems

Diet Frequently More Important than Drugs.

INSTRUCTION NINETEEN
Cooking.
Forty-two Pages, 349 to 390

DOMESTIC SCIENCE

How to Prepare Food for the Family Table.

Directions for Cooking—Suggestions and Recipes.

INSTRUCTION TWENTY
Liquid Foods.
Thirteen Pages, 391 to 403

Liquid and Semi-Liquid Foods for Fever and Other Patients

Beef Teas — Broths — Soups — Jellies — Gruels — Drinks.

PART FOUR — FIRST AID

One Hundred and Seventeen Pages, 404 to 520

ACCIDENTS AND EMERGENCIES

Bandages, Hemorrhages, Wounds, Sprains, Dislocations, Fractures, Removal of Wounded, Artificial Breathing, Resuscitation of the Drowned, Asphyxia from Gas, Poisoning, Insensibility, Fits, Burns, Scalds, Choking and Frost-Bite.

INSTRUCTION TWENTY-ONE
Bandages.
Twenty-five Pages, 404 to 428

How to Apply Bandages

How to Support Injured Parts, Keep Dressings in Place, Fix Splints, Stop Bleeding, Protect Wounds from Exposure, Stop Milk Secretion.

INSTRUCTION TWENTY-TWO
Hemorrhage.
Thirteen Pages, 429 to 441

Escape of Blood from the Heart or Bloodvessels

The Cause—Situation—Symptoms. Varieties of External or Internal Hemorrhage.

HOW TO GIVE IMMEDIATE RELIEF.

INSTRUCTION TWENTY-THREE
Wounds.
Six Pages, 442 to 447

Simple and Poisoned Wounds

Including Poisonous Stings of Insects, Snake Bites, Dog Bites, Etc.
Their Definition and Treatment.

INSTRUCTION TWENTY-FOUR
Sprains and Dislocations.
Five Pages, 448 to 452

Quick Treatment for Sprains, Strains, Dislocations, and Fractures.

Definition, Causes and Signs.

INSTRUCTION TWENTY-FIVE
Removal of Injured.
Fourteen Pages, 453 to 466

How to Move or Transport the Sick or Injured

REMOVAL BY HAND OR STRETCHER.

INSTRUCTION TWENTY-SIX
Artificial Respiration.
Nine Pages, 467 to 475

How to Restore Breathing by Artificial Means

Asphyxia — Drowning — Choking — Hanging — Strangulation — Poisonous Gases — Signs of Death.

INSTRUCTION TWENTY-SEVEN
Poisoning.
Twenty-eight Pages, 476 to 503

Poisons Injurious to Health and Destructive to Life

General Precautions. What to Do Quickly in Case of Poisoning. How to Know and Avoid Poisonous Plants.

Special Poisons, their Symptoms, and their Immediate Treatment.

INDEX TO ILLUSTRATIONS.

A LESSON IN ANATOMY

Copy of the Famous Painting by Rembrandt. By the Official Photographer of The Art Institute, Chicago.

PART ONE—*Anatomy and Physiology*

The Wonderful Structure

of

The Human Body

The Size, Shape and Situation of the Various Organs Describing the Uses and Functions of the Organs and the Way in Which They Do Their Work.

INSTRUCTION ONE—*The Human Body*

Anatomy is the study of the **structure** of the body, and of the size, shape, and situation of the various organs which compose it.

Physiology is the study of the **uses** and **functions** of these various organs, and the way in which they do their work.

Every living creature, animal or vegetable, is built up of **Cells.** A cell in its simplest form consists of a mass of a clear jelly-like substance called **Protoplasm** (from Greek words meaning "the first

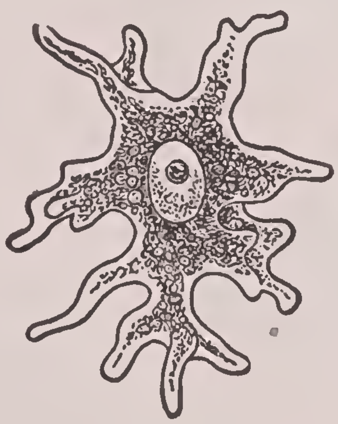


Fig. 1. The *ameba,* a very low form of animal, much like a speck of jelly. Highly magnified.

thing formed"); in the interior of this mass of clear substance is a thicker and darker portion known as the **Nucleus.** The nucleus is, in fact, a sort of kernel, round which the protoplasm is situated.

In order to understand the structure (anatomy) and functions (physiology) of a simple cell, we may take as an example the **Amœba,** one of the lowliest forms of animal life, which is found in ponds and

ditches. A microscope is necessary, as the creature is too small to be seen without its aid. It consists of one single cell, an irregular mass of clear protoplasm with a nucleus inside. If we watch for a while, we shall see that it is able to **move about.** This it accomplishes by stretching out a part of the protoplasm, called a **pseudopodium,** or "false foot," as if it were a foot, and then drawing the rest of itself along.

In the course of its wanderings it comes across a small particle of matter, possibly a tiny mass of protoplasm smaller than itself. It thrusts out a part of its protoplasm, surrounds the particle and **takes it into itself** or **ingests** it; presently the particle can be seen in the interior of the cell to have been broken up into smaller particles, and after a while these vanish; they have, in fact, been **eaten and digested** by the amœba. In the case of particles, such as mineral dust, which it cannot digest, it soon rejects them, or even refrains altogether from taking them in. It is therefore **selective** of its food.

After a time the nucleus of the cell, which has grown larger, divides into two parts; these separate from one another, each half taking with itself a portion of the protoplasm of the cell, and soon the whole cell is seen to divide completely so as **to produce two new amœbæ,** each resembling the original one in every particular.

The amœba, then, shows all the **phenomena characterizing a living animal,** namely:

1. The power of movement.
2. The power of receiving from outside matter which serves it as food.
3. The power of digesting that food and making it into protoplasm like itself, **assimilating** its food.
4. The power of multiplying or reproducing itself.

The amœba, in fact, is an animal composed of one single cell; and every one of the functions or duties of a living animal is carried on by the one cell; the cell moves, digests and multiplies.

A higher animal, on the other hand, is made up of millions of cells, which are not all capable of doing anything and everything as is the amœba cell. In the human body, for instance, certain cells are told off for certain definite duties; some go to make **bone,** the supporting structure; others to make **muscles,** the organs of movement; others, again, are specially adapted for purposes of digestion; and so on. Moreover, one kind of cell cannot do the work of another kind: the muscle cell cannot perform the duties of digestion, nor can the digestive cell do the work of a bone cell.

This division of the cells into groups, each group having its own special structure and function, or **differentiation** and **specialization**, divides the work and enables the cells to do each its own kind of work better. This is termed **division of labor.** It makes the

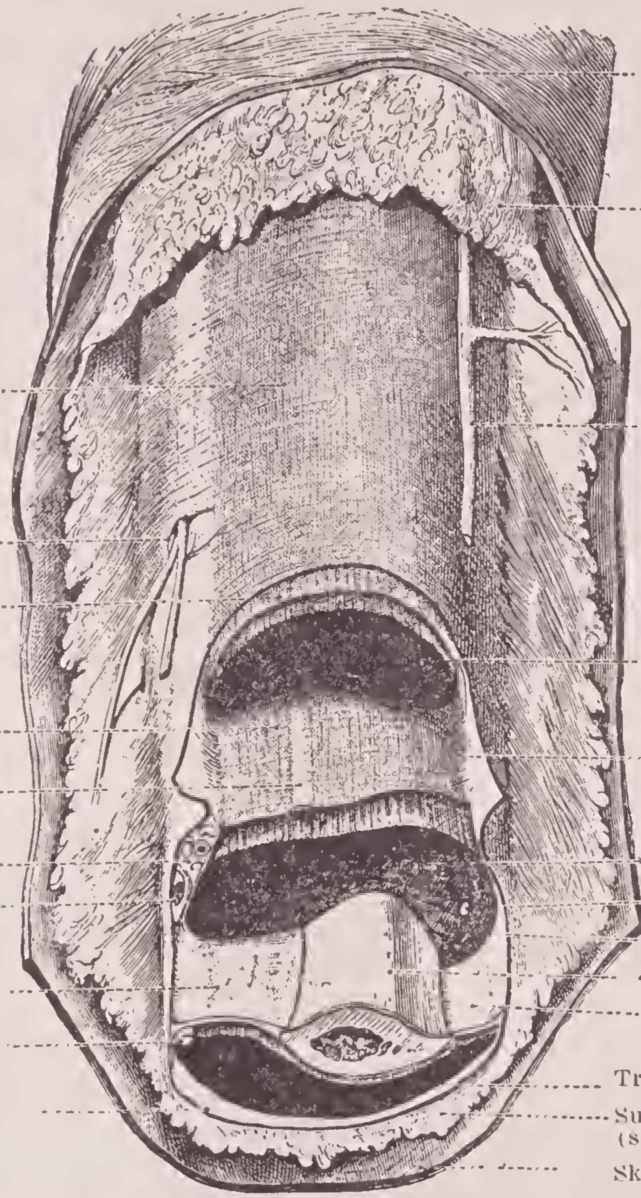


Fig. 2. A dissection of the arm to show the relation of the various layers of tissue in an extremity.

anatomy and physiology of the human body a much more complex study than that of the amœba, in which the several phenomena can be followed out in a single cell under the microscope.

The human body consists of the following parts:

I. **Head** (skull and face), which is connected by the **neck** to

II. **The Trunk,** which is divided into two cavities:

(a) The **thorax,** or **chest.**

(b) The **abdominal cavity**, which is again subdivided into

The **abdomen proper**, or **belly.**

The **pelvis.**

III. **Two Pairs of Limbs,** an upper (**arm**) and lower (**leg**).

The human body is made up of a combination of **systems.** Each system has similarity of structure of its parts and fulfills certain **functions** or uses; that is, does some kind of work in the general economy or business of the body.

1. **The Skeletal System,** or **Skeleton.**—This is made up of bones, ligaments or fibrous bands, and cartilages or so-called "gristle." It is the framework of the body. It gives form and support to the soft parts, and with the muscles makes up the apparatus for locomotion or movement of the parts of the body or of the body as a whole.

2. **The Muscular System** comprises the muscles and their tendons. The muscles are made up of the **lean meat,** and the tendons are the shining, white, fibrous bands at the ends of the muscles, by which these latter are attached to the bones.

3. **The Nervous System.**—This is made up of the brain, spinal cord, sympathetic trunk, and the nerves, and the organs of special sense—sight, hearing, etc. It gives unity to the body as a whole, combining the many parts into an individual or unit, and placing the body in communication with its surroundings.

4. **The Circulatory System** comprises the heart, blood-vessels (arteries, veins, and capillaries), lymph-vessels and lymph-glands (including the "milt" or spleen). It carries nourishment to all parts of the body, and removes waste-matter by conveying it to the excretory organs.

5. **The Respiratory System.**—This includes the lungs, trachea or windpipe, and larynx or "voice-box." In this system is thus included the vocal or speech apparatus. It purifies and oxygenates the blood; that is, it removes certain waste-substances from the blood and supplies it with oxygen.

6. **The Digestive System.**—This consists of the alimentary canal (mouth, gullet, stomach, and intestine) and its associated structures, the mouth, tongue, teeth, salivary glands, liver, and pancreas, or "belly sweet-bread."

7. **The Urogenital System** includes the urinary and the reproductive organs. Thus it comprises: (**a**) the organs of excretion (the kidneys, ureters, urinary bladder and urethra), and (**b**) the organs of reproduction, male and female.

8. **The Integumentary System** consists of the skin, hair, nails, etc. It is protective and sensory (gives us sensations of heat and cold, touch, pain, etc.) and has also the very important duty of regulating the temperature of the body by giving out more or less heat.

These systems are made up of **tissues**, which in turn are made up of **cells.** A **cell** is a minute piece of protoplasm or fundamental substance of life; it has a little **nucleus** or **kernel** which is its controlling part. A **tissue** is made up of cells, all of the same kind. Several tissues are joined and interwoven or mingled in building up each **organ** of the body. An organ has a special function or work and the several organs are so related as to form the systems described above. The study of the minute structure of the body requires the use of the microscope. It is termed Histology.

The parts of the body may be studied either as they occur together, in juxtaposition, which is Topographical Anatomy (which the surgeon must know); or as they occur in systems, Systematic Anatomy. The latter is convenient for the purposes of description and is the plan chiefly followed in this book. In the descriptions it is everywhere assumed, for clearness and conciseness, that the body is in the natural, living, active position, namely, erect. The **mesial** or **middle plane** divides it into a right and a left half. The halves of the body are for the most part **symmetrical**; that is, each half is like a mirror-reflection of the other half. This is not strictly true, however, as the right half is always larger in right-handed persons, and **vice versa.** In the internal organs there is still greater lack of symmetry, as may be seen by reference to the figures of the body-contents.

The Thoracic Cavity.

The Thorax.—This is an air-tight conical chamber, with walls composed of a bony framework (the dorsal vertebræ, the ribs with their cartilages, and the sternum or breast-bone) and muscles; its upper end is closed in on each side by the first rib and the muscles at the root of the neck, its lower end by the midriff (diaphragm). This is a thin, dome-shaped structure, mostly muscular, but in part tendinous. The inner surface of the cavity is lined by a thin transparent membrane—the **pleura.**

The chief organs contained within the thoracic cavity are:

I. The **two lungs,** one placed in each lateral half of the chest, in which it is suspended by the bronchus and the pulmonary vessels, which enter it on its medial surface at a

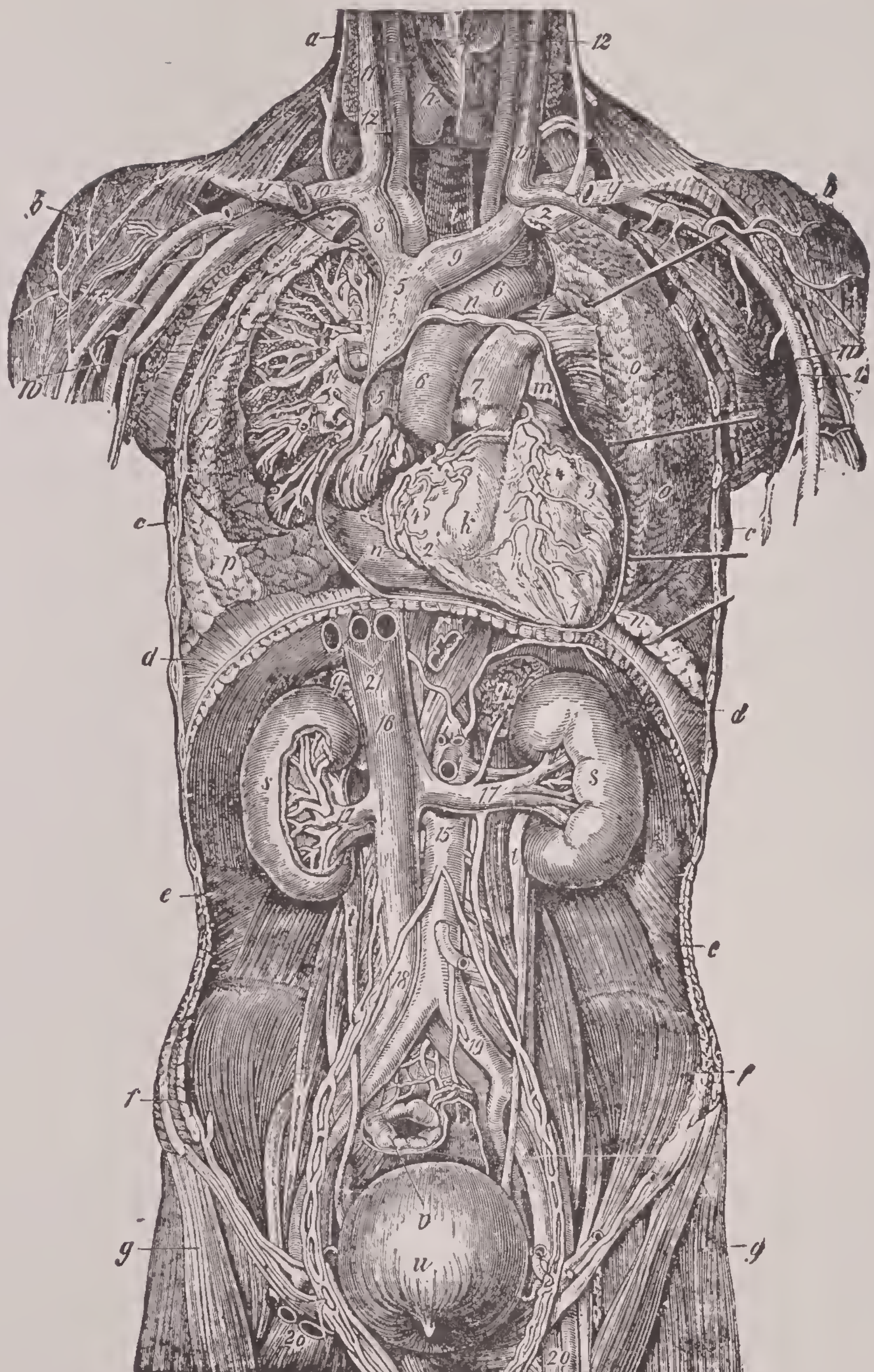


Fig. 3. Thoracic and Abdominal Cavities, opened from in front; the digestive organs have been removed from the abdomen to show the parts related to the posterior wall.

a, Neck. b, Shoulder. c, Wall of thorax. d, Diaphragm or midriff. e, Wall of abdomen. f, Pelvis. g, Thigh. h, Thyroid gland and larynx. i, Windpipe. k. Heart. l, Right auricle. m, Left auricle. n, Pericardium. o, Left lung pulled aside to show its root. p, Right lung partly removed to show the pulmonary blood vessels. q, Suprarenal bodies. r, Lower end of the gullet, cut across. s, Kidneys, right one partly removed. t, Ureters leading from the kidneys to u, Urinary bladder. v, Large bowel (rectum). w, Axilla, or arm-pit. y, Collarbone. z. First rib. 1, Apex or point of heart. 2, Right ventricle. 3, Left ventricle. 4, Blood vessels of wall of heart. 5, Upper vena cava. 6, Aorta. 7, Pulmonary artery. 8, Right and 9, left innominate veins. 10, Subclavian vein. 11, Internal jugular vein. The external jugular is to the outer side of it. 12, Carotid artery. 13, Axillary artery. 14, Pulmonary arteries and veins. 15, Abdominal part of the aorta. 16, Inferior or lower vena cava. 17, Renal arteries and veins. 18, Junction of femoral veins. 19, Femoral arteries. 20, Femoral nerve, artery and vein (to the leg). 21, The veins from the liver, cut off where they leave the liver and enter the inferior vena cava.

point behind, and a little above, the center. This point is called the root of the lung. On it the pleura passes on to the lung to cover it completely. The pleura is a thin, moist, smooth membrane which thus both lines the space in which the lung lies and also covers the lung itself by a second layer. The lung can thus move, or get larger and smaller, with **very** little friction. In pleurisy, or inflammation of the pleura, there is much friction and pain because the pleura is then roughened.

II. The **heart** (surrounded by its membranous bag, the pericardium), placed between the lungs, lying obliquely across the lower two-thirds of the sternum and projecting more into the left than into the right side of the chest. Through the thoracic cavity passes the **œsophagus** (gullet), and in it end or arise the great blood-vessels. Like the lung, the heart is covered by a smooth membrane and lies in a cavity which is lined by a continuation of the same membrane, the **pericardium.**

The Abdominal Cavity.

The Abdomen proper—with more or less flaccid walls—is formed behind by the lumbar vertebræ, in front and at the sides by muscles. Above it is roofed in by the diaphragm, below it is open into the pelvis.

The inner surface of the abdomen is lined by a thin transparent membrane, the **peritoneum,** which also covers the surfaces of the abdominal organs, and attaches the greater part of the small intestine (the jejunum and ileum) to the posterior wall of the abdomen by a broad double fold, **the mesentery.**

The organs contained within the abdomen are:

I. The stomach.

II. The small intestine, consisting of three parts:
- (a) The duodenum.
- (b) The jejunum.
- (c) The ileum.

III. The large intestine, consisting of six parts:
- (a) The cæcum (to which is attached the vermiform appendix).
- (b) The ascending colon.
- (c) The transverse colon.
- (d) The descending colon.

(e) The sigmoid flexure.

(f) The rectum. It terminates in the "anal canal," which is always closed except during the passage of feces; it is about an inch long.

IV. The pancreas (belly sweetbread).

V. The spleen (milt).

VI. The liver and gall-bladder.

VII. The kidneys, with their ducts, the ureters.

VIII. The suprarenal capsules.

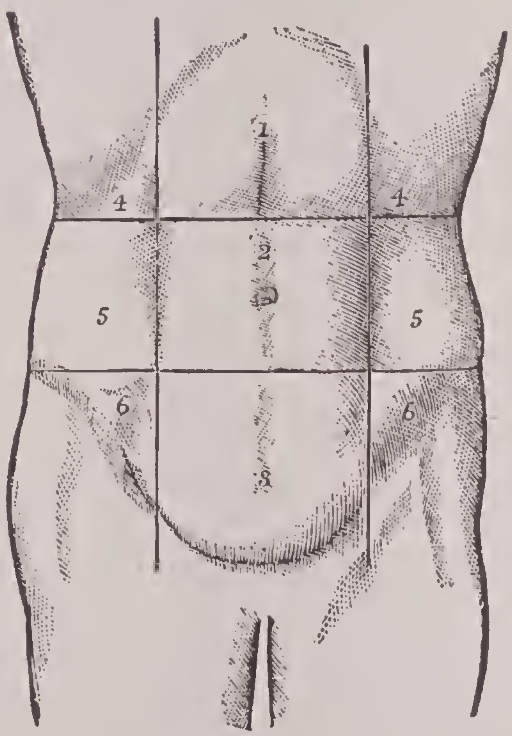


Fig. 4. The abdominal regions. 1, Epigastric region ("pit of the stomach"). 2, Umbilical region (about the navel or umbilicus). 3, Hypogastric region: the lower part of it is the pubic region. 4, Hypochondriac regions—right and left. 5, Lumbar regions, loins or flanks—right and left. 6, Iliac region; the lower part of each is the inguinal region. The line below 4 4 is level with the lowest ribs; that below 5 5 is level with the top of the hip-bones.

The positions of the abdominal organs are as follows:

Under the left arch of the diaphragm is the stomach.

Under the right arch of the diaphragm is the liver.

In the center and lower part of the abdomen lie the coils of small intestine.

In the right groin lies the cæcum and appendix.

In the right flank is the ascending colon.

Across the front of the abdomen is the transverse colon.

In the left flank lies the descending colon.

In the left groin lies the sigmoid flexure.

Transversely across the back of the abdomen is placed the pancreas.

Over and behind the stomach, under the lower ribs of the left side, is placed the spleen.

In the posterior wall, on each side of the spinal column, are placed the kidneys, the right one being close under the liver, and the left one close under the spleen.

On the upper end of each kidney is a suprarenal capsule or adrenal.

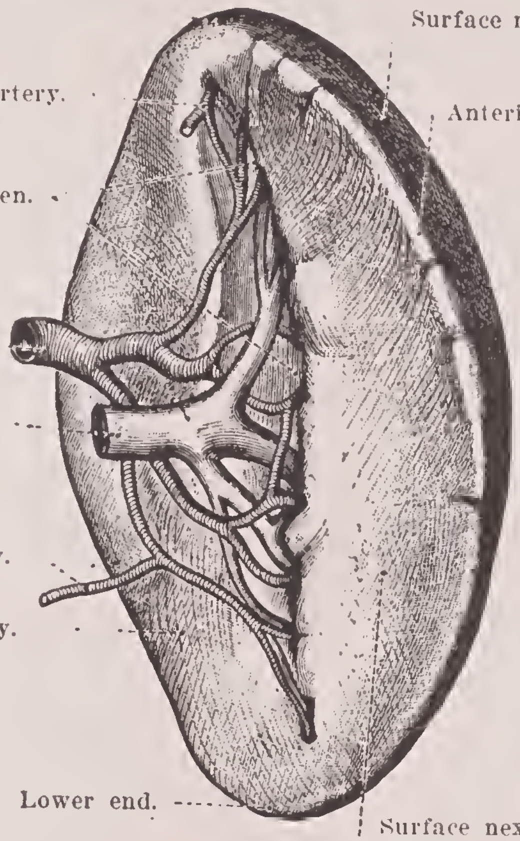


Fig. 5. The spleen or milt. It is covered by peritoneum everywhere except along the line where the blood vessels join it.

The Pelvis.—This is a basin-shaped bony structure lined with muscles; these complete the walls where the bony parts are absent. It

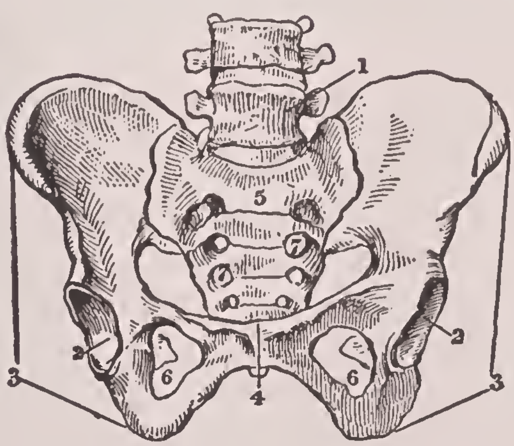


Fig. 6. The bones of the pelvis. 1, Last lumbar vertebra. 2, Acetabulum or socket of hip-joint. 3, Hip-bone. 4, Symphysis pubis, or joint of the pelvis. 5, Sacrum. 6, Thyroid, or obturator, foramen. 7, Opening for the spinal nerves to pass to the pelvis.

communicates above with the abdomen proper, and it is closed in below by a muscular floor, in which is situated the external opening of the rectum—the anus.

The contents of the pelvic cavity are:

I. The urinary bladder, lying in the center, with the ureters opening into its base behind (and bringing down the urine from the kidneys).

II. The rectum (termination of the large intestine), which is placed behind the bladder.

III. Some of the organs of reproduction.

INSTRUCTION TWO—*Skeleton, Muscles, Etc.*

Description of The Skeleton—The Muscles and Soft Part Covering Skeleton

THE BONES.

Composition of Bone.—Bone is composed partly of animal and partly of mineral matter. If a bone is calcined or burnt, it loses one-third of its weight, owing to the destruction and removal of the animal matter; two-thirds of its weight, therefore, or the remainder, consist of mineral matter, chiefly phosphate of lime.

The tissue of a bone is of two kinds: (1) **Compact,** dense, white, and like ivory; (2) **cancellous,** or spongy, looking something like a honeycomb; in the spaces within the spongy part is lodged **red marrow** which is concerned in the production of blood-cells.

Compact tissue is found on the outside of bones, forming a covering shell, and cancellous in the interior.

Forms of Bones.—Bones vary in form according to the uses which they serve. There are three varieties:

(1) **Long Bones,** such as those of the limbs, which are used chiefly as levers upon which muscles may act so as to produce movements.

(2) **Flat Bones,** for example, the scapula or shoulder-blade, the sternum or breast-bone, and many of the skull-bones; these serve for purposes of protection or covering in of cavities containing important structures.

(3) **Irregular Bones,** such as the vertebræ, the small bones of the hand and foot, etc. These have special uses according to their situation.

Structure of a Long Bone.—If we take, for example, the femur, or thigh-bone, we see that it consists of three parts: the **head,** or upper extremity; the **shaft**; and the **lower extremity.** The shaft is the narrowest part of the bone, which widens out above and below. This is to give larger surfaces to which are attached the joint-ligaments and muscle-tendons. It also gives a larger surface for the pressure

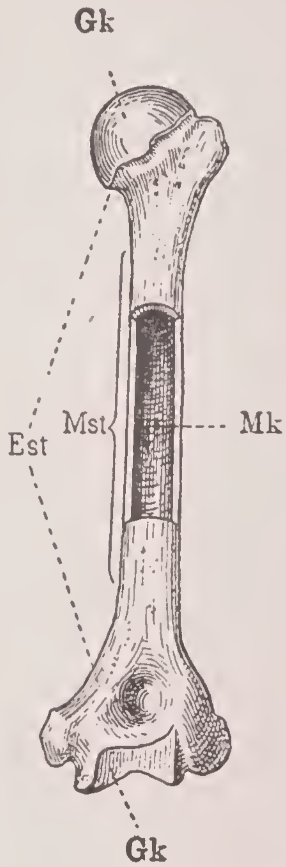


Fig. 7. The humerus, or arm-bone as an example of a long bone. Gk, Articular or joint surfaces. Est, Extremities. Mst, middle piece, body or shaft. Mk, Marrow-cavity. The interior of the ends is spongy—the marrow there is in numerous little cavities instead of being in one large space as in the shaft.

between the bones forming the joint. At each end of the bone will be found a smooth, ivory-like surface, which during life is covered with **cartilage,** or gristle, and forms part of a joint. About the middle of the shaft there is a small hole leading into the inside of the bone; this is the **nutrient canal**; it affords a passage for the bloodvessels carrying nourishment to the bone. If we saw the bone in two from top to bottom, we find that the whole is covered with a layer of dense, compact bone; this ivory-like layer is much thicker in the middle of the shaft than at the extremities, where it thins out to a mere shell. The extremities are found to consist mainly of cancellous bone, which extends down into the shaft, but does not fill up the whole cavity. A large portion of the shaft is hollow, and is occupied during life by **marrow,** which is very important in relation to blood formation. This hollowness of the long bones serves two purposes: first, it makes

them lighter; secondly, it adds to their strength, a cylinder or tube being able to resist much more strain than a solid rod of the same weight.

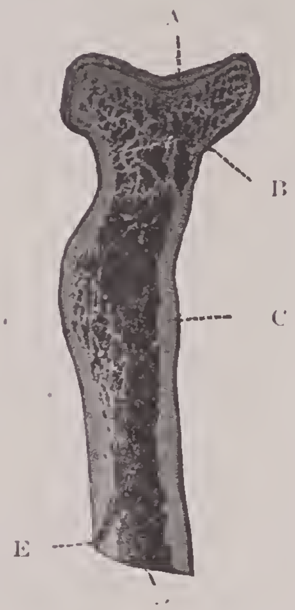


Fig. 8. The upper end of the radius (bone in the thumb side of the fore-arm), sawed through to show the structure of a long bone. A, Articular cartilage covering the head of the bone where it comes against the humerus. B, Spongy bone. C, The compact bone enclosing D, the marrow-cavity. E, The canal for the artery to the marrow.

Nourishment of Bone.—Bones, like every other part of the body, receive their nourishment from the blood. Their blood-supply is twofold: (1) The **nutrient artery**, passing in by the nutrient canal

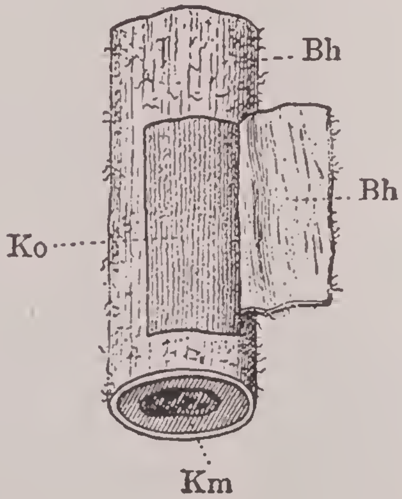


Fig. 9. Structure of a long bone. Bh, Periosteum or bone-membrane. Ko, Compact bone. Km, Bone-marrow (or medulla) in the marrow-cavity.

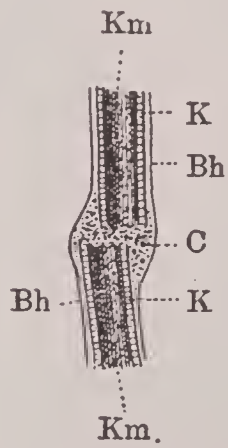


Fig. 10. A bone after fracture and healing. Km, Marrow. K, Compact bone. Bh, Periosteum. C, Callus, new bone which unites the broken ends.

and reaching the interior of the bone; (2) the small vessels of the **periosteum**, a tough fibrous sheath, which during life closely enwraps the bone, and takes considerable force to detach it.

Growth of Long Bones.—In the earliest stages of development a mass of cartilage is laid down in the situation of the future bone.

This cartilage is composed of **cells** lying in a clear substance known as the **matrix.** Lime-salts are deposited in the matrix, which thus becomes **calcified,** and then by a complex process bone is formed. Masses of cartilage persist for many years near the ends of the long bones, and by the growth of these, and extension into them of bony tissue, the bone is enabled to **grow in length** until the individual has attained his full stature. The **periosteum** is a source of new bone, as well as of nourishment to that which already exists; from it are formed layers of new osseous tissue on the surface of the old, and thus the bone **grows in thickness.** At the same time the inner surface of the bone is absorbed, the marrow cavity being thus enlarged.

Classification of Bones.—There are 214 bones in the adult human body. Several of these are formed by the fusion of two or more bones into one mass during growth. They may be grouped as follows:

I. **The Skull,** consisting of 28 different bones. These are divided into:

(1) 8 **Cranial** bones, forming the brain-case.

(2) 14 **Facial** bones, providing a framework on which the structures of the face are built up.

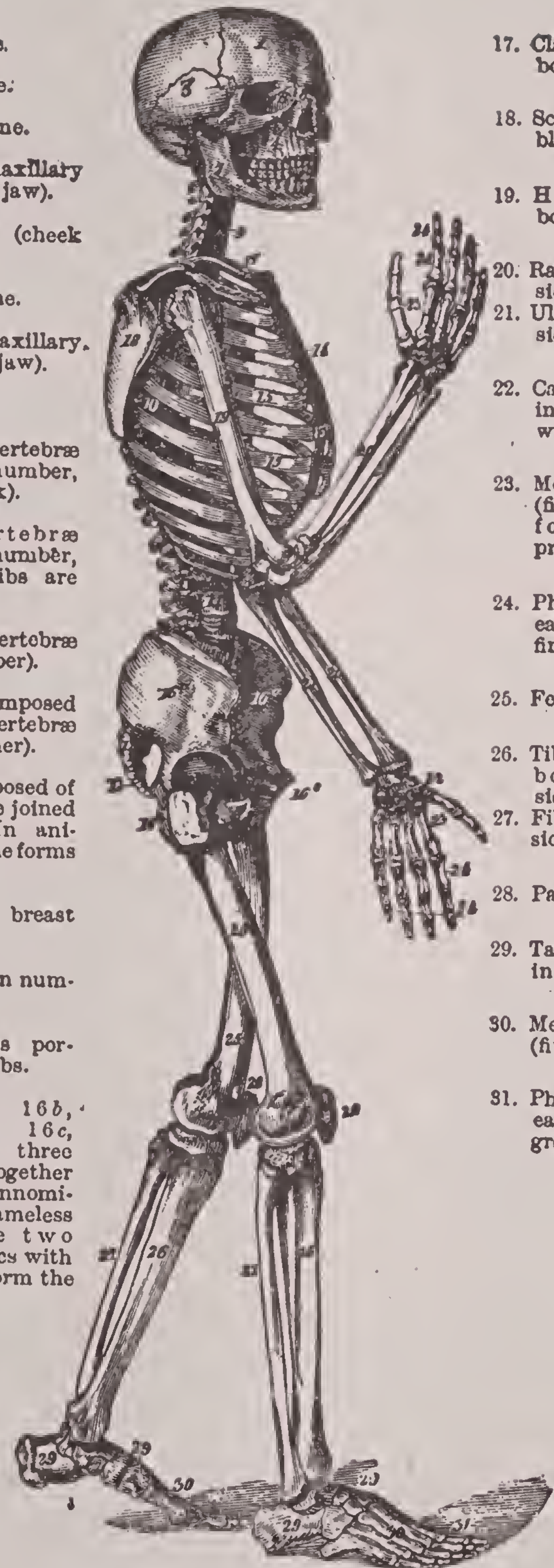
(3) 6 small bones, the **auditory ossicles,** 3 in each ear.

II. **The Bones of the Trunk,** 54 in number:

(1) The **Spinal Column** is made up of a number of irregularly-shaped bones, the **Vertebræ,** united by joints and elastic substance, so that, although the movement between each pair is slight in amount, the column as a whole is very flexible. The upper 24 vertebræ remain separate bones; below them is the **Sacrum,** a bone formed by the fusion of 5 vertebræ which are separate in early life but later unite into one mass; the **Coccyx** is the lowest part of the spine, and is formed by the union of 4 rudimentary vertebræ.

A typical vertebra consists of two parts: the **body,** a thick, rounded portion lying in front; and the **neural arch,** formed by two thinner plates of bone springing from the sides of the body and meeting behind. The bodies of the vertebræ lie one above the other, with a thick pad of cartilage, the **intervertebral disc,** between each pair. This column of bodies bears the weight of the head, upper limbs, and trunk. The neural arches also lie one above another, and thus form a canal extending the whole length of the spinal column; in this canal is situated during life the **Spinal Cord,** from which nerves pass out on each side between the vertebræ to all parts of the trunk and limbs.

(2) The **Sternum,** or breast-bone, forms the front of the thorax.



1. Frontal bone.
2. Parietal bone.
3. Temporal bone.
4. Superior maxillary bone (upper jaw).
5. Malar bone (cheek bone).
6. Lacrimal bone.
7. Inferior maxillary bone (lower jaw).
8. Nasal bone.
9. Cervical vertebræ (seven in number, forming neck).
10. Dorsal vertebræ (twelve in number, to which ribs are attached).
11. Lumbar vertebræ (five in number).
12. Sacrum (composed of five vertebræ joined together).
13. Coccyx (composed of four vertebræ joined together). In animals this bone forms the tail.
14. Sternum, or breast bone.
15. Ribs (twelve in number).

15*a*. Cartilaginous portion of the ribs.

16*a*, ilium; 16*b*, ischium; 16*c*, pubes—these three portions together form the os innominatum, or nameless bone. The two nameless bones with the sacrum form the *pelvis*.

17. Clavicle or collar-bone.
18. Scapula or shoulder blade.
19. Humerus or arm-bone.
20. Radius, outer side. } Bones of fore-arm.
21. Ulnar, inner side. } Bones of fore-arm.
22. Carpal bones (eight in number, forming wrist).
23. Metacarpal bones (five in number, forming hand proper).
24. Phalanges (three for each finger, forming fingers).
25. Femur, or *thigh*-bone.
26. Tibia or shin-bone, inside. } Bones of leg proper.
27. Fibula, outside. } Bones of leg proper.
28. Patella, or knee-cap.
29. Tarsal bones (seven in number).
30. Metatarsal bones (five in number).
31. Phalanges (three for each toe, two for great toe).

PLATE I.—The skeleton.

(3) The **Ribs,** twelve pairs, pass from the spinal column, where they are attached by joints, and form the sides and part of the back and front of the thorax; in front the upper seven pairs are fastened by cartilages to the sternum; of the next three pairs each rib is attached to the cartilage of the one above; and the lowest two pairs, the **Floating Ribs,** are unattached in front.

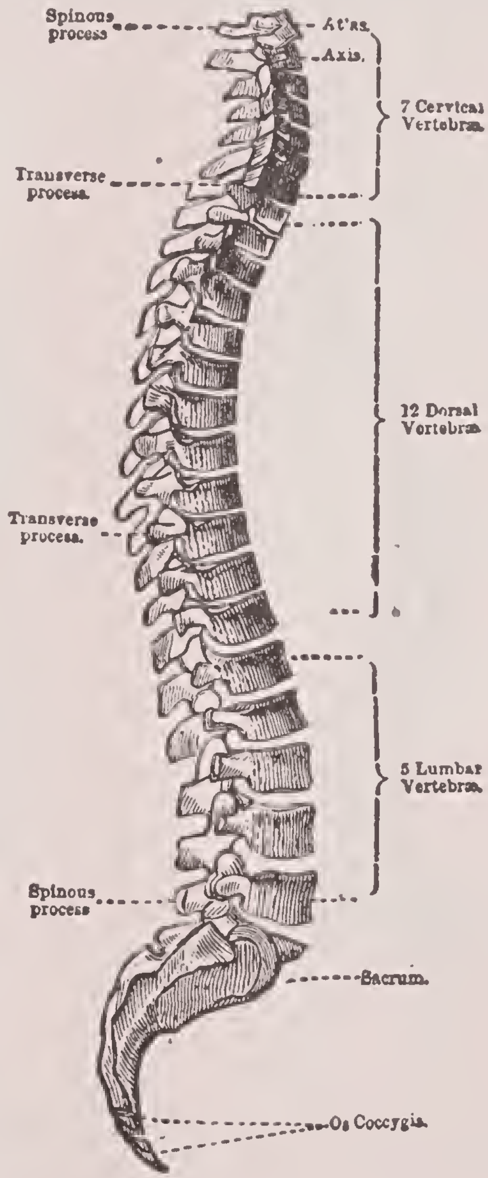


Fig. 11. The backbone or spinal column, showing its several regions. The ribs are attached to the dorsal vertebræ, and the hip-bones are attached to the sacrum.

The **Thorax,** in its natural state, when undeformed by disease or tight clothes, is a cone diminishing upwards, and truncated (having its top cut off); the ribs being arched and elastic, and being attached in front by cartilage and behind by joints, are enabled to move freely up and down as the thorax changes its shape during the expansion of the lungs in respiration.

(4) The **Hyoid Bone,** shaped like a horseshoe, supports the tongue,

giving attachment to its muscles as well as to others which pass up the front of the neck.

(5) The **Hip-Bone,** or **Innominate** (one each side), is formed by the fusion of three separate bones, viz., the ilium or hip-bone, the ischium or seat-bone, and the pubic bone.

The **Pelvis** is the basin-like cavity formed by the hip-bones at the sides and front, and the sacrum and coccyx behind.

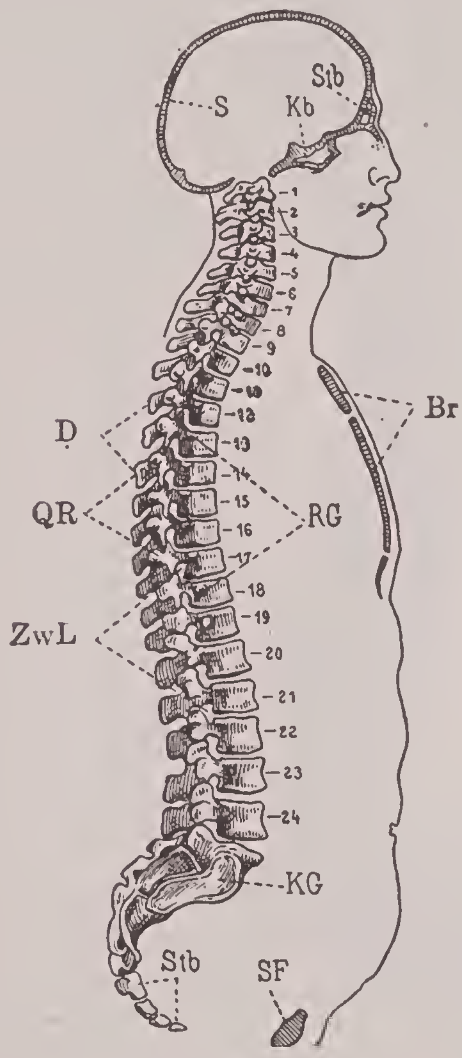


Fig. 12. The bones in the middle plane of the body. Br, Breastbone or sternum. Stb, Frontal or forehead bone. S, Occipital bone. Kb, Sphenoid bone. 1-24, The vertebræ forming the spinal column. D, Spines of the vertebræ; these can be felt and seen in the middle line of the back of the body and neck. QR, The transverse process of the vertebræ. RG, The articular surfaces on the bodies of the vertebræ with which the heads of the ribs articulate. ZwL, The intervertebral openings through which the spinal nerves pass out from the spinal cord within. Stb, The coccyx, the rudimentary terminal part of the spinal column. KG. The sacrum with which the hip-bones articulate (or are joined) on each side. SF, The symphysis pubis or anterior joint of the pelvis.

III. **The Bones of the Upper Limbs,** 32 in each:

The **Clavicle,** or collar-bone, the only bone of the upper extremity which is attached to the bones of the trunk, hence it is often broken in falling on the hands; the **Scapula,** or shoulder-blade, which gives attachment to the humerus in the shoulder-joint; the **Humerus,** or bone of the upper arm; the **Radius** and **Ulna,** or bones of the forearm; when the arm hangs by the side with the palm forward and the thumb outwards, the radius lies to the outer side of the ulna—that is to say, the ulna is nearest the body. There are 8 **Carpals,** or wrist-

bones; 5 **Metacarpals**, or hand-bones; and 14 **Phalanges**, or finger-bones.

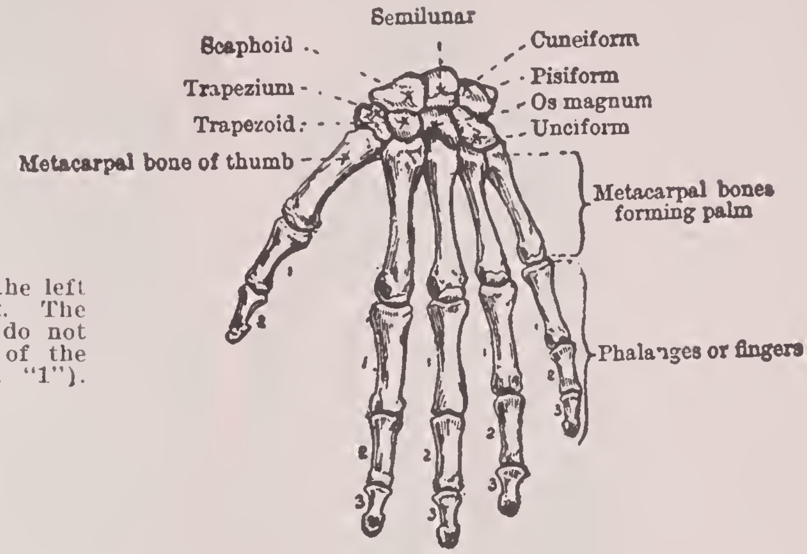


Fig. 13. The bones of the left hand, seen from the back. The clefts between the fingers do not reach to the upper ends of the first phalanges (numbered "1").

IV. **The Bones of the Lower Limbs**, 30 in each:

The **Femur**, or thigh-bone; the **Patella**, or knee-cap; the **Tibia**, or shin-bone; the **Fibula**, a slender bone to the outer side of the tibia; 7 **Tarsal**, or ankle-bones; 5 **Metatarsals**, or foot-bones; 14 **Phalanges**, or toe-bones.

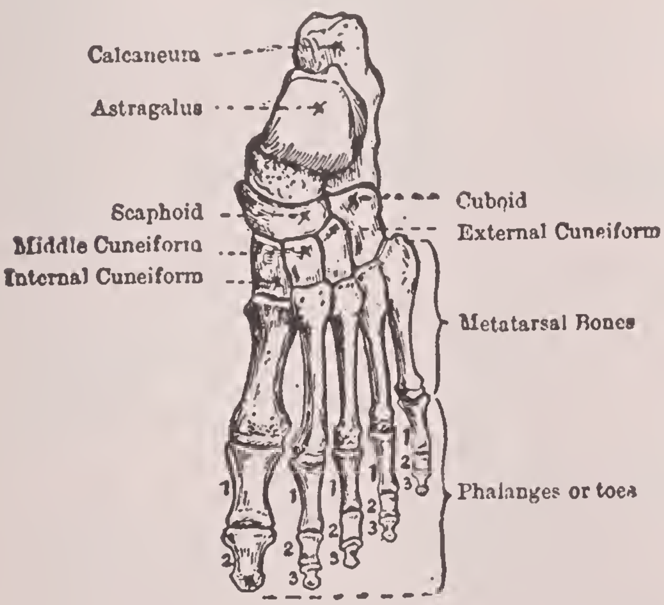


Fig. 14. The bones of the right foot, seen from above. The clefts between the toes extend to about the middle of the first phalanges (or toe-bones).

Besides all these, there are 8 **Sesamoid Bones**, formed near the joints of the thumb and great-toe, two to each.

The Joints.

Bones are connected together and may move upon one another by means of joints. A joint is usually made up of the ends of two

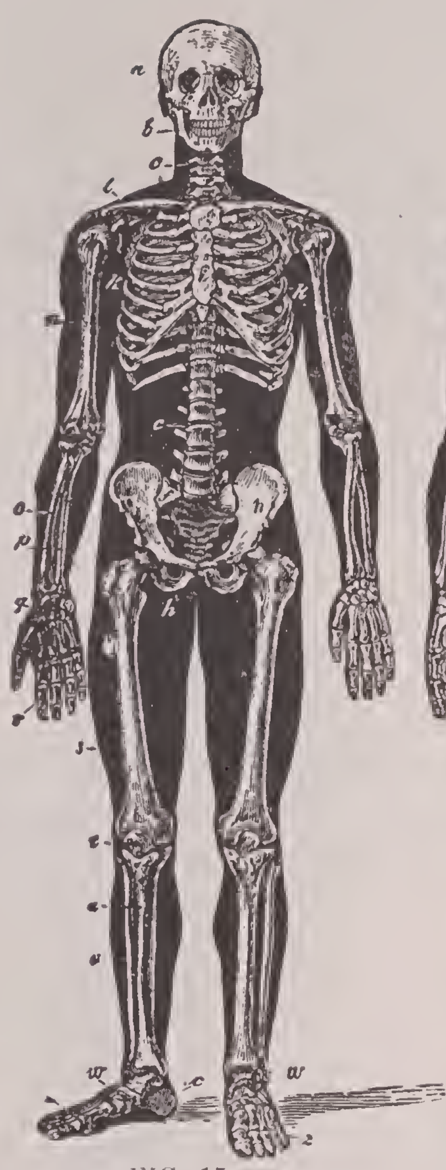


FIG. 15.
The skeleton and the flesh seen from in front.

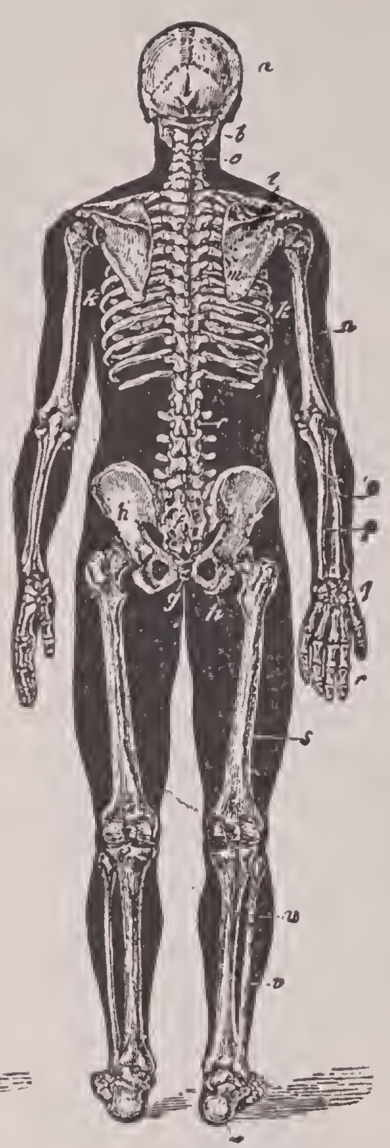


FIG. 16.
The same, seen from behind.

a, Skull.
b, Face.
c, Neck or cervical vertebrae.
d, Thoracic vertebrae.
e, Lumbar vertebrae.
f, Sacrum.
g, Coccyx, f. and g. form the lowest part of the spine.
h, Pelvis (made up of the two hip bones and the sacrum).
i, Breastbone or sternum.
k, Ribs.
l, Collarbone or clavicle.
m, Shoulder blade or scapula.
n, Upper arm bone or humerus.
o, Radius.
p, Ulna (elbow bone); o and p, form the forearm.
q, Wrist and broad of the hand or carpus and metacarpus.
r, Fingers or digits.
s, Thigh bone or femur.
t, Knee cap or patella.
u, Shin bone or tibia.
v, Fibula.
w, Ankle and broad of the foot.
x, Heel.
z, Toes.

bones, which are covered with smooth cartilage and held together by ligaments (strong fibrous bands) and muscles. Often one bone is hollowed out to receive the end of the other. The hollow is deepened by a ring of cartilage. The enlarged end of bone is termed the head of the bone. Stretching from one bone to the other there is a loose

fibrous covering, termed the joint capsule. Parts of it are thick and are called ligaments, but the latter may also be outside the capsule altogether. Joints are of different kinds:

I. **Immovable Joints.**

(a) The **Suture, e. g.**, the zig-zag union of most of the skull-bones.

(b) The **Synchondrosis,** where cartilage is interposed between the bones, **e. g.**, the union of the hip-bones to the sacrum.

II. **Partly-movable Joints,** or symphyses, **e. g.**, the joints between the bodies of the vertebræ.

III. **Movable Joints.** In this form cartilage covers the ends of the bones forming the joint; there is a **joint-cavity**; these joint-surfaces are free, are very smooth, and are lubricated by fluid **synovia** secreted by a delicate synovial membrane, which lines the whole of the interior of the joint, except the parts of the bones covered by cartilage. The bones are held together by firm fibrous bands, or **ligaments,** which check or limit movements in different directions. These are torn, more or less, in **sprains** and in **dislocations.** The different kinds of movable joints are:

a. The Gliding Joint, where one bone slides over the surface of the other; for example, the joints of the small wrist-bones on one another.

b. The Hinge Joint, allowing only flexion and extension; for example, the elbow joint.

c. The Condyloid Joint, in which movement can take place forwards, backwards, and from side to side; for example, the wrist joint.

d. The Ball-and-Socket Joint, in which movement can take place in every direction; for example, the shoulder and hip joints.

e. The Pivot Joint, which allows only of rotation; for example, the joint between the radius and the ulna in the elbow, which allows the hand to turn to and from you while the elbow is bent.

The Muscular System.

The Muscular System.—The muscles are the lean meat. Their special property is **contractility,** by which they are adapted to the function of movement not only of the body as a whole as in walking, but also of its parts, as in breathing, swallowing, etc. The **voluntary** muscles, under control of the will, are connected with the skeleton. They are made up of elongated cylindrical, thread-like **muscle-fibers** which have a cross-striation; hence these muscles are also termed **striated.** The fibers are bound together by fibrous connective tissue,

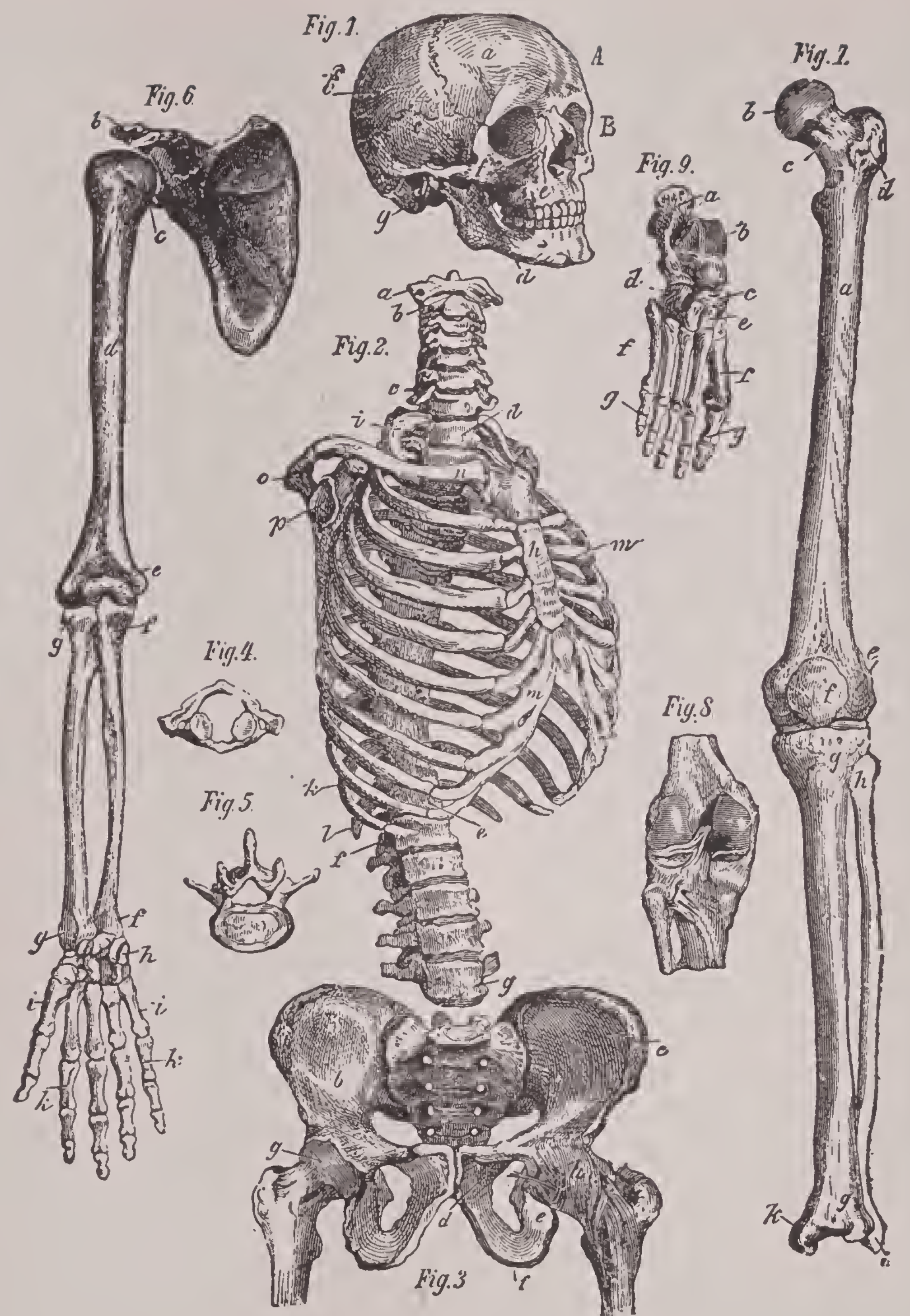


Fig. 17. Various parts of the skeleton.

Fig. 1. The bony head. A, Skull. B, Face. a, Frontal or forehead bone. b, Parietal or wall bone. c, Temporal bone. d, Lower jaw bone (mandible). e, Upper jaw bone (maxilla). f, Cheek bone. g, Outer ear passage.

Fig. 2. The skeleton of the trunk. a, Atlas or first cervical (neck) vertebra (termed "Atlas" because, like Atlas, the Greek myth, it bears up the sphere, or head). b, Axis, or second neck vertebra, which allows the head to turn from side to side. c, Last or seventh neck vertebra. d, First, and e, last (or twelfth) dorsal or thoracic vertebra. f, First, and g, last (fifth) lumbar vertebra. h, Breast bone or sternum. l, First rib. k, Eleventh, and l, twelfth rib. m, Rib (or costal) cartilages, which join the ribs to the breast bone. n, Clavicle. o, Acromion, or point of the shoulder. p, Joint surface, on the shoulder-blade, for the arm bone.

Fig. 3. The bony pelvis. a, Sacrum. b, Hip bone. c, Wing, or iliac, part of b. d,

and are atached either directly to the bone or indirectly by means of **tendon.**

The **involuntary, smooth,** or **non-striated** kind of muscle occurs in the walls of bloodvessels, in the stomach and intestine, and other hollow viscera or internal organs; also in the erector muscles of hairs. Such muscle acts more slowly than the striated and is not under control of the will. A special kind of muscle is that of the heart, so-called **cardiac** or **involuntary striated.** Like the skeletal muscles it is striated but it is not under voluntary control. Some muscles are red, while others are pale. The difference is well seen in the breast and the leg muscles of fowl, so-called "light meat" and "dark meat." The red muscles are capable of more prolonged action but are not so rapid in action as the white or pale.

Tendons are firm, inelastic structures occurring chiefly at the ends of muscles and attached to bone. They yield gelatin when boiled in water. Where they pass over joints and slide on the bones they are contained in smooth sheaths of synovial membrane which allows of free, frictionless movement. These sheaths may become inflamed when bruised or when there is excessive muscular action. They are then very painful. Such inflammation is termed **synovitis.**

Where muscles or tendons play over other muscles or tendons or over long prominences **bursæ** or pockets of synovial membrane are present to facilitate free movement.

By exercise or work the muscles are strengthened. The blood-supply is increased during use, hence increased nourishment and growth results provided the use be not excessive. This training is also in part an effect on the nervous mechanism, especially of the centers which control the movements. Thus, when we learn any new game or develop skill in doing things, it is more a matter of training the brain and spinal cord than of developing the muscles.

Pubic bone. e, Ischiatic or "sitting" bone, on which the body rests when sitting. f, Ischiatic tuberosity. g, Head of the femur or thigh-bone. h, Capsule of the hip-joint.

Fig. 4. Atlas, or first neck vertebra.

Fig. 5. Sixth thoracic vertebra. (The thoracic vertebrae are those which have ribs attached to them and which help to form the thorax.)

Fig. 6. The bones of the upper extremity. a, Scapula or shoulder-blade. b, The acromion, a projection of the scapula, forming the bony part of the shoulder and united by a joint with the collar-bone. c, The head of the humerus. d, The shaft of the humerus. e, The joint surface of the lower end of the humerus; g g, The radius; f f, The ulna; these are the two bones of the forearm. h, Carpus, or wrist-bones. k k, The phalanges, or finger-bones; there are two in the thumb and three in each finger.

Fig. 7. The leg-bones. a, The femur, or thigh-bone. b, Its globular head, for the hip-joint. c, Its neck. d, Its trochanter. e, Its enlarged lower end for the knee-joint. f, The patella, knee-cap, or knee-pan. g g, The tibia, or shin-bone. h, The fibula. r, The inner (or medial) ankle-bone (lower part of tibia). i, The outer or lateral ankle-bone.

Fig. 8. The knee-joint seen from behind.

Fig. 9. The bones of the foot, seen from above. a, The heel-bone. b, c, d and e, the tarsus (corresponds to the wrist). f f, The metatarsus (corresponds to the palm-bones), g g, toe bones or phalanges.

Locomotor Apparatus.—The voluntary muscles, or those under control of the will, are nearly all attached to bones and can move these at the various joints. The bones and muscles thus form a combination of **lever-systems,** by which the various movements of the body or its parts are carried on. A lever is a rigid body capable of turning about a fixed point called the **fulcrum.** The force that moves it is termed the **power** and the force that is applied by the lever in lifting a weight, moving a body or overcoming resistance is

Fig. 18. The muscles of the back and neck. 1, Nodding muscle (sternomastoid). 2, "Hood" muscle (trapezius). 3, Deltoid, raises the arm. 4, Broadest muscle of the back; goes to the arm, and draws it down and back. 5, Great gluteal or buttock muscle; helps to stand erect, hence is very large in man. 6, Crest or edge of hip-bone. 7, Spines of the backbone.

termed the **weight.** The weight and the power may be regarded as acting each at a point. The part of the lever between the fulcrum and the power is the **power-arm;** that between the fulcrum and the weight is the **weight-arm.** The lengths of these vary and so the relation of the size of the power to the size of the weight varies. The longer the power-arm the larger the weight may be, but the slower will the latter be moved. Conversely a short power-arm will

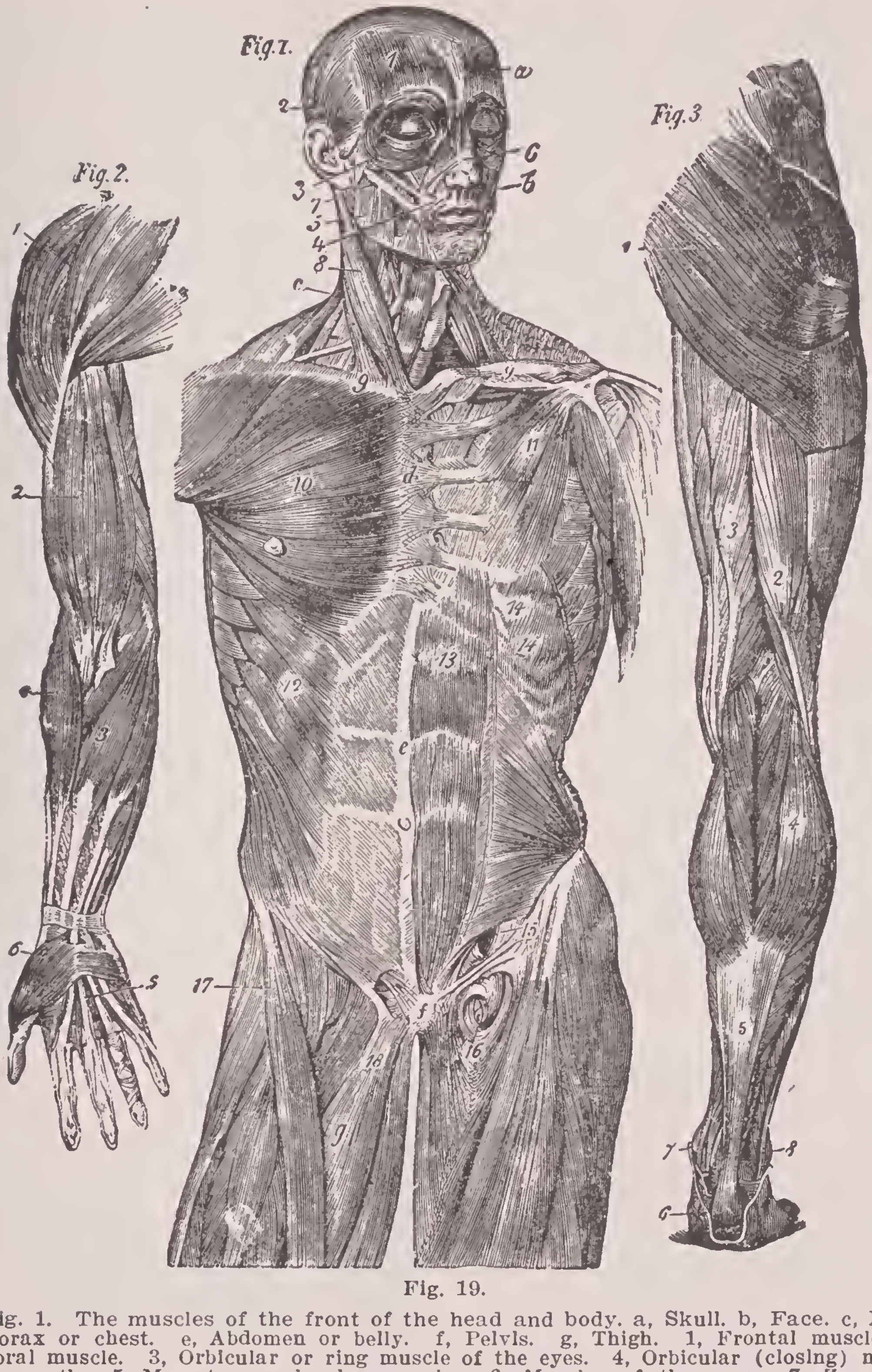


Fig. 19.

Fig. 1. The muscles of the front of the head and body. a, Skull. b, Face. c, Neck. d, Thorax or chest. e, Abdomen or belly. f, Pelvis. g, Thigh. 1, Frontal muscle. 2, Temporal muscle. 3, Orbicular or ring muscle of the eyes. 4, Orbicular (closing) muscle of the mouth. 5, Masseter or chewing muscle. 6, Muscles of the nose. 7, Zygomatic (or yoke) muscle. 8, Head nodding muscle (sterno-mastoid). 9, Collar-bone. 10, Large pectoral or breast muscle. 11, Smaller ditto. 12, Oblique abdominal muscle. 13, Straight ditto. 14, Intercostal muscles (between the ribs). 15, Inguinal ring or opening for the spermatic cord. 16, Femoral opening for large vein. These openings, 15 and 16, are the common sites of hernia or rupture. 17, Sartorius or tailor muscle. 18, Adductor muscle (draws the thigh inward).

Fig. 2. Arm muscles. 1, Deltoid (raises the arm). 2, Biceps (bends the elbow and also turns the hand palm upward). 3, Radial flexor (bends the wrist). 4, Brachioradial (bends the elbow and also turns the hand palm upward). 5, Lumbrical (or worm-like) muscles (bends the fingers). 6, Muscle that bends the thumb.

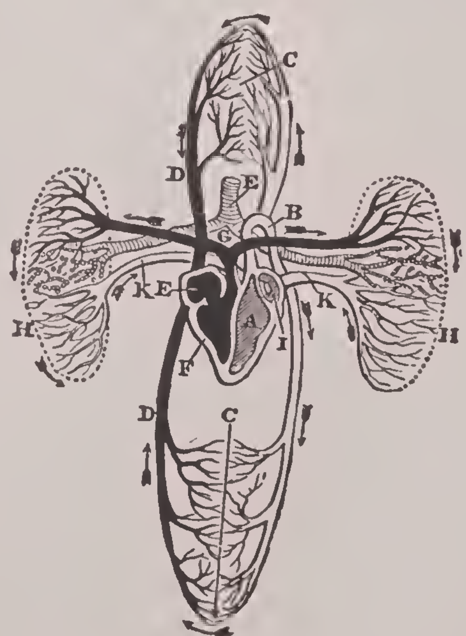
Fig. 3. Leg muscles. 1, Gluteal or buttock muscle (helps to keep the body erect, hence is large). 2 and 3, Hamstring muscles, which bend the knee (and also help to straighten the hip). 4, Calf muscles. 5, Tendon of Achilles. (4 and 5 raise the heel off the ground, i. e., raise the body on the toes.) 6, Heel. 7 and 8, Inner and outer ankle bones.

move only a small weight, but will move it rapidly. Thus it is that the many complex movements of the body are effected, some rapidly but without much force, others slowly and powerfully.

The nerves are very important in the movements of the body. Some carry impulses to the muscles to cause these to contract in the proper order, rate and degree; other nerves carry impressions to the brain, by which the muscle-contractions are regulated or correlated. Thus, if either kind of nerve is out of action the movements are disordered or absent. If the motor nerves, or the parts of the central nervous system from which they come, are paralyzed the muscles can not be made to contract voluntarily and are said to be **paralyzed.** Again, when the sensory nerves, or the centers to which they go, are diseased the muscle-movements can not be regulated but are either excessive, wrongly combined or even in great part absent. It is evident then that in order that we may have the full use of our bodily movements the following structures must be healthy: 1. The bones, especially those of the arms, legs, and spinal column. 2. The joints by which these bones are connected and yet left free to move. 3. The muscles attached to these bones. 4. The nerves (motor) going to these muscles. 5. The nerves (sensory) coming from the muscles and adjacent parts; also the organ of equilibrium which is a part of the inner ear, and the organ of vision, both of which help to keep us informed of our position and movements in space. 6. The parts of the spinal cord to which the nerves go or from which they come. 7. The parts of the brain with which we **feel** and **will,** so-called **sensory** and **motor** centers, and the tracts or parts between these and the spinal cord.

FIG. 20. SIMPLE DIAGRAM OF THE CIRCULATION OF THE BLOOD.

A, Left ventricle or heart-chamber which pumps the blood into B, The aorta or large artery which gives off branches that carry the blood to all parts of the body. C, The capillaries joining the arteries over to the veins. D, The large veins which carry the blood back to the heart-chamber, E, (the lower) from which it goes to F, the right ventricle; this pumps it through the G, the pulmonary artery, to the lungs, where it is purified and then returns through the pulmonary veins, K, to I, the left auricle. It passes then to A and begins the round again. The upper E is the windpipe. The arrows show the direction of the blood-flow. The venous or impure blood is represented by black, and the arterial or pure blood by white.



How the Heart Pumps the Blood Through the Arteries

The Veins Collect the Blood and Carry it Back to the Heart. Then it is Purified by the Lungs.

Subject Reference

For Diseases of the Heart See Vol. 2, pages 467 to 470

When We Take Air Into the Lungs Oxygen Passes Into the Blood.

Then Poisonous Gas and Animal Poisons are Given Off by the Lungs.

Circulation of the Blood

Blood is the nourishing fluid of the body, and the **Circulatory System** distributes blood to every part.

Circulatory System.—This consists of (1) the **heart,** which pumps or propels the blood forward into (2) the **arteries** which carry it to all parts of the body; (3) the **capillaries** or fine, hair-like tubes with thin walls that permit exchange of nutriment and waste-substances between the blood and the tissues; (4) the **veins** which collect the blood and carry it back to the heart, thus completing the **circulation** or round of the blood. The heart is a great hollow muscle. It has four chambers, two auricles and two ventricles. These are provided with **valves** which are doors opening only one way so that they direct the flow of the blood always in one direction. Thus the **right auricle** receives the venous or impure blood by the **inferior** and the **superior vena cava** from the body in general and from the wall of the heart itself. The blood passes through the tricuspid valve into the **right ventricle** which pumps it into the lungs through the **pulmonary artery** and its branches. In the lungs the venous blood is purified or oxygenated (takes up **oxygen** and loses carbon dioxide and other impurities) as it passes through the **pulmonary capillaries,** where it comes into close relation with the air in the air chambers of the lungs. The **pulmonary veins** collect the blood when it is thus **arterialized** and carry it to the **left auricle.** It then passes through the **mitral** or **bicuspid valve** into the **left ventricle.** This pumps it into the large **aorta,** by whose branches, **the arteries,** it goes to every part of the body carrying nourishment to the tissues. The **systemic capillaries** connect the arteries with the smallest veins; these unite to form larger veins continually by which the blood is carried finally into the venae cavae and so again to the heart. It is easily seen that the circulation is double—the blood passes through the heart twice in making one complete round. The circulation through the lungs

is the **pulmonary**; that through the body is the **systemic.** The auricles are the receiving chambers of the heart, and the ventricles are the pumps, and to them really belong all the valves. Of these one set, the tricuspid on the right and the bicuspid or mitral on the left, prevents the blood's going back into the auricles; the other set, the semilunar, are situated at the beginning of the large arteries (pul-

FIG. 21.

FIG. 22.

Diagram of the heart and its valves. RV, auricle or receiving chamber. RK, ventricle or pumping chamber. Note that the valves are opened alternately. Only one side of the heart is represented. The arrow shows the direction of the blood current. In Fig. 21 the ventricle, RK, is relaxing and filling; in Fig. 22 it is contracting and emptying itself and the valves compel all the blood to go in the right direction unless they are defective and leaky, as in some forms of heart disease, when part of the blood escapes backward and so the heart has extra work to do.

monary on the right and aorta on the left) and prevent the blood's returning into the ventricles when those relax after forcing the blood into the arteries.

The heart is about as big as its owner's fist. It is situated in the thorax or chest, a little to the left of the middle plane of the body, so that two-thirds lie to the left and one-third to the right of this plane. The apex of the normal heart is situated below the left fifth rib, medial to a vertical line through the nipple. The base of the heart is opposite the second costal cartilage of the left side or just below it. One surface of the heart lies on the diaphragm and one is directed forward and upward towards the ribs. The heart beat may be seen where the apex or point of the heart strikes the chest wall; it can also be felt and heard.

The pericardium is a sac in which the heart lies. It has a very smooth, moist inner surface formed by a thin membrane which at the base of the heart passes on to the latter and covers it completely. Thus the surface of the heart is smooth and moist and the cavity in

which it lies is also smooth so that the movements and changes in size of the heart are carried on with the least possible friction.

The arterial system begins with the **Aorta**, a large vessel passing up from the left ventricle. The opening between the aorta and the

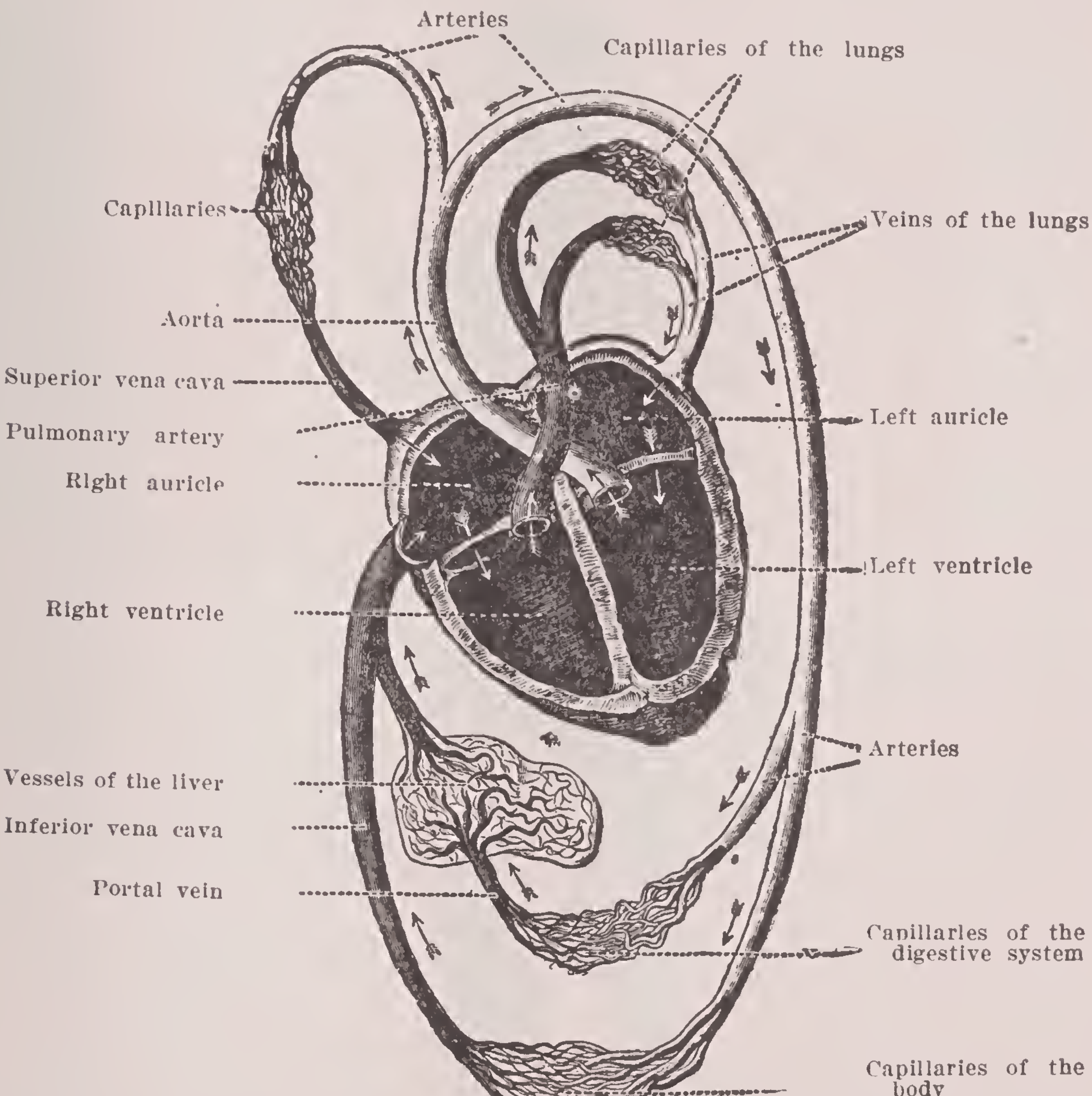


Fig. 23. Diagram of the Circulatory System. The arrows indicate the direction of the blood current.

ventricle is guarded by three pocket-shaped flaps, the **Semilunar Valves,** which by their closure prevent blood from flowing back into the ventricle from the aorta when the heart relaxes or dilates.

The **Pulmonary Artery** leaves the right ventricle, the opening being guarded, as in the case of the aorta, by three semilunar valves. It divides into two branches, one entering each lung. All the blood must pass by means of the pulmonary artery to the lungs to be

purified. It returns to the heart from the lungs by four **Pulmonary Veins** which open into the left auricle.

From the other parts of the body the blood is brought back by large veins, which ultimately gather themselves into two big vessels,

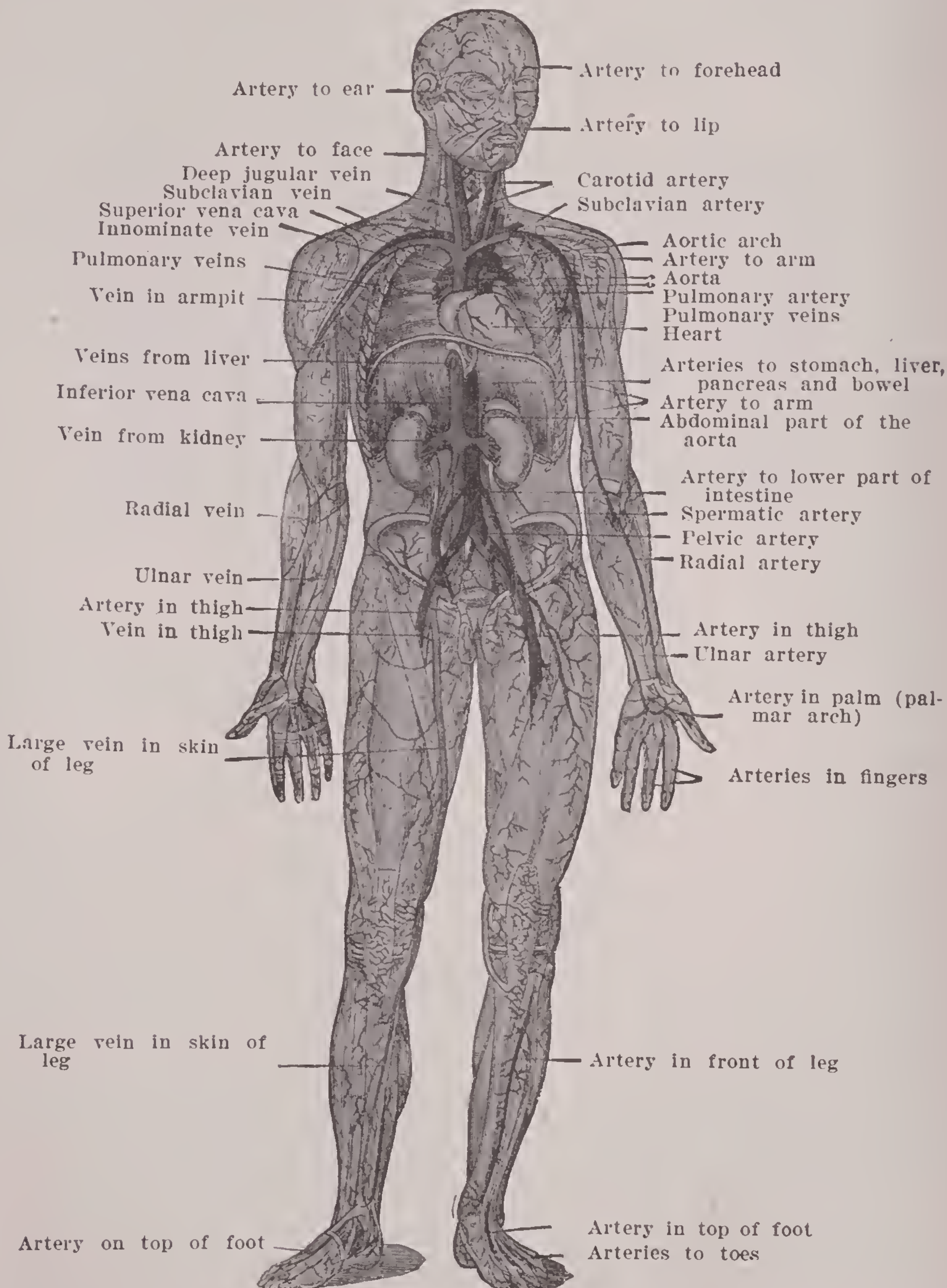


Fig. 24. The chief arteries and veins of the human body, showing their relation to surface, in the head, neck, and extremities. The front wall of the body is removed and also many of the internal organs.

the **Superior Vena Cava**, bringing blood from the head, neck, and upper limbs, and the **Inferior Vena Cava**, bringing blood from all the lower parts; these two trunks open into the right auricle.

The Main Arteries of the Body.—The Aorta, the principal artery of the body, starts from the left ventricle. It passes upwards on the right side of the spine, and then **arches** across to the left side, descending along the left side of the spine; in the thorax it pierces the diaphragm, passes into the abdomen, and divides opposite the fourth lumbar vertebra into two branches—the iliac arteries, which go to the lower limbs.

From the **arch** of the aorta three trunks arise:

1. From the right side of the arch, the **Innominate** artery, which divides into

(a) The **Right Common Carotid**, carrying blood to the right side of the head and neck.

(b) The **Right Subclavian**, to the right upper limb.

2. The **Left Common Carotid**, the second branch, to the left side of the head and neck.

3. The **Left Subclavian**, the third branch, to the left upper extremity.

Each common carotid artery divides on a level with Adam's apple into branches:

(a) The **Internal Carotid**, which goes to the brain.

(b) The **External Carotid**, which supplies branches to the head and face.

The **Subclavian** artery passes in an arch over the first rib. At the lower edge of the rib it is continued into the armpit (axilla) as

The **Axillary**, which extends across the axilla into the arm, where it is continued as

The **Brachial**, which passes along the inner border of the biceps muscle to an inch below the bend of the elbow: here it divides into two branches:

(a) The **Radial** artery, which extends along the outer side of the forearm to the wrist.

(b) The **Ulnar** artery, which extends along the inner side of the forearm to the wrist.

In the palm the radial and ulnar are connected by two vessels—the **superficial** and **deep Palmar** arches, from which branches are given off to the fingers and hand.

In the thorax the aorta gives off a number of branches, the chief being:

The **Intercostal** arteries—ten on each side—to supply the chest-wall.

In the abdomen the principal vessels given off by the aorta are:

(i) The **Cœliac Axis**, which divides like the spokes of a wheel into

(a) The **Gastric**—to the stomach.

(b) The **Splenic**—to the spleen.

(c) The **Hepatic**—to the liver.

(ii) The **Renal**—to the kidneys.

(iii) The **Mesenterics, superior mesenteric** and **inferior mesenteric**—to the intestines.

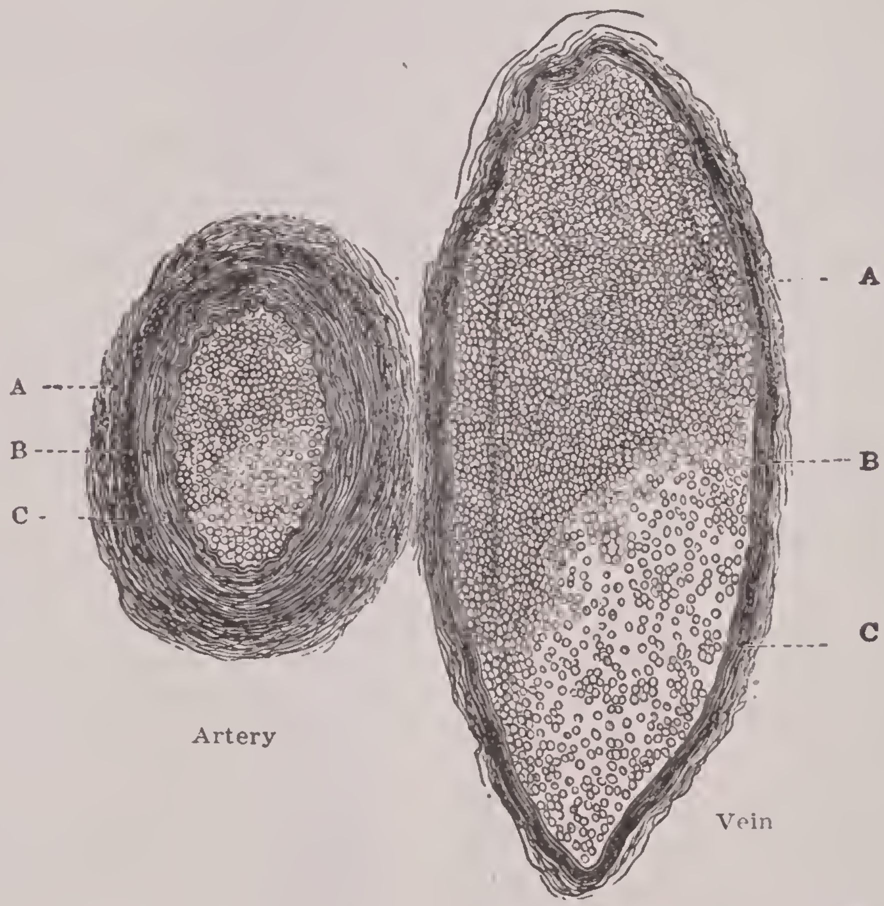


Fig. 25. An artery and its accompanying vein cut across to show how they compare in size and in the character of their walls. A, The loose, fibrous, outer coat. B, The muscular coat, much thicker in the artery; it can contract and so lessen the amount of blood passing through. C, The thin inner coat; within this is the lumen or cavity of the vessel. The blood flows with much more force and speed in the artery, which is narrower than the vein. Much magnified.

The **Common Iliac** arteries pass into the pelvis, and each divide into two branches:

(a) The **Internal Iliac**—to the organs in the pelvis.

(b) The **External Iliac**, which passes along the wall of the pelvis to the middle of the fold of the groin; here it emerges from the abdomen, enters the thigh, and becomes

The **Femoral**, which passes down the thigh to the inner side and into the ham, where it becomes

The **Popliteal**, which passes along the middle of the ham, behind the knee and just below the bend of the knee divides into

(a) The **Anterior Tibial**, which coming to the front between the two bones of the leg passes down to the ankle, and is continued on to the upper surface of the foot as the **Dorsalis Pedis** artery or dorsal artery of the foot.

(b) The **Posterior Tibial**, which runs down the back of the leg, and passes round behind the inner ankle to the sole of the foot; it gives off as a branch the **Peroneal** artery, which passes down the back of the leg to the heel and outer ankle. On entering the sole the posterior tibial artery divides into two branches:

(a) The **External Plantar** artery.
(b) The **Internal Plantar** artery.

These supply the toes and sole of the foot.

Structure of Bloodvessels.—The **Arteries** after death are found to be empty of blood. This is owing to their muscular walls which contract at death and then are filled with air when the flesh is cut into and these vessels cut across. For that reason the ancients thought that during life they contained air. The word "artery" comes from two Greek words meaning "air-containing."

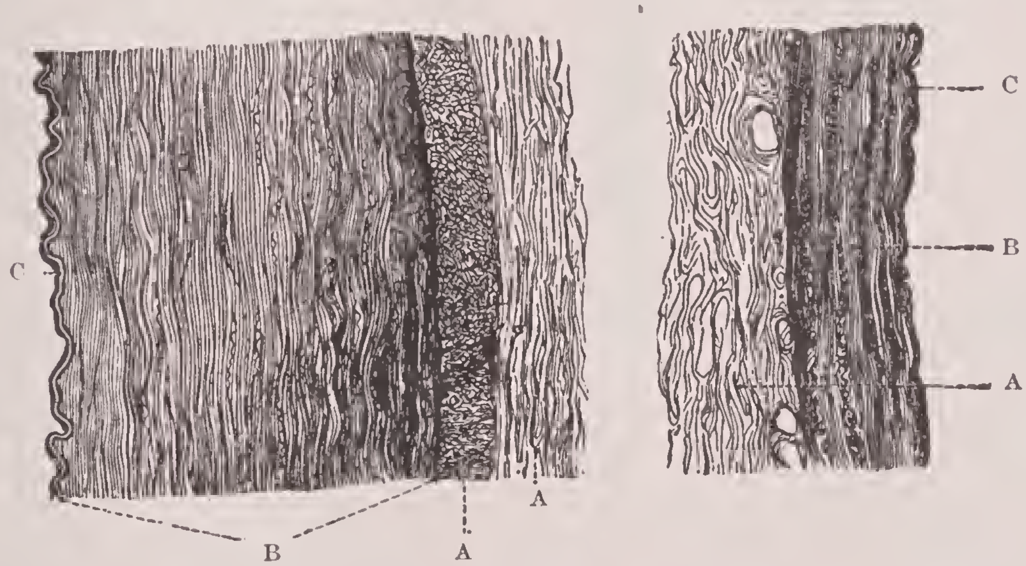


Fig. 26. The wall of the main artery and vein of the arm, in front of the elbow, magnified 60 times. To show the make-up and comparative thickness of the wall of an artery and of a vein. A, fibrous outer coat; has two layers in the artery. B, Muscular middle coat, very thick in the artery. C, very thin inner coat.

The wall of an artery is very elastic like rubber tubing. The elasticity is very important; if the arteries were rigid and could not expand the flow through them would be by intermittent jerks, each

jerk corresponding to a heart-beat; the artery, however, expands as the blood is forced into it by the heart, and this expansion can be felt as the **Pulse** in parts of the body, such as the wrist or temple, where an artery comes near the surface. When the heart-beat is over, the artery contracts on the blood in it, forcing it onwards into the tissues until the next heart-beat fills and expands it once more. By this means a continuous supply or flow of blood is kept up.

Structure of Arteries.—These are strong, elastic tubes with three layers in their walls. The inner layer is formed of flat, pavement-like cells, the **endothelium**; the middle layer is formed chiefly of smooth, spindle-shaped, muscle fibers which have a circular or transverse direction, and are mixed with a good deal of elastic fibers; the outer coat is fibrous and by it the artery is fixed in place and attached to adjacent structures. The middle coat is the most important as it gives strength to the artery wall, and also by its muscle regulates the diameter of the artery and adjusts the rate at which the blood flows along. The arteries have no valves. They branch repeatedly and become smaller at each division. Some of the branches **anastomose** or are joined to each other by cross-branches. Neighboring

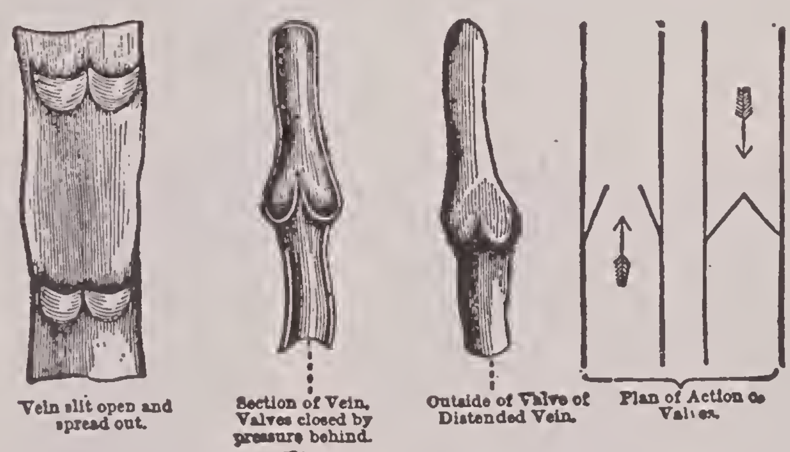


Fig. 27. The valves of veins. They help to cause the blood to flow toward the heart in the veins.

arteries are often thus joined so that when one main artery gets accidentally blocked, its branches may be filled and supplied with blood by the anastomoses.

Structure of Veins.—The veins have the same three coats as the arteries, but the muscle is less in amount and the white fibrous tissue is more abundant. Veins have valves, which are pocket-like structures with the mouth of the pocket directed or open towards the heart. The valves are usually in pairs and as they become filled and distended they stretch across the lumen or opening within the vein and close it so that the blood can not pass back but must flow always

towards the heart. The position and action of these valves may be seen by striking one's forearm lightly from the elbow towards the wrist. The veins anastomose very freely and so provide many routes by which the blood can pass around any point where there is closure of the veins by external pressure.

Structure of Blood-Capillaries.—These are very minute tubes, of which the wall is formed by a single layer of plate-like cells which are joined edge to edge and are curved so as to give a cylindrical form to the capillary. Each cell is much like a pen-nib which is pointed at both ends. This thin wall readily allows the fluids of the blood to pass out and carry nourishment to the tissues, and also permits waste-matters to be taken into the capillaries and carried

Fig. 28. Capillary blood-vessels of a lobule (or little mass) of fat, to show the connection between a small artery, 1, and a small vein, 2. The blood flows quickest in the artery (which is narrow), slowest in the capillaries (which together form a wide channel).

away in the blood to be cast out in the lungs or in the kidneys. White blood cells, or leucocytes, can also pass into or out of the capillaries, penetrating the wall without, however, leaving a hole behind, for it closes up at once much the same as a soap-bubble does when a wet finger is thrust into it and then withdrawn.

The Lymphatic Circulatory System.—This consists of many wide, thin-walled canals which for the most part accompany the veins, and which resemble the latter in structure. The lymphatic vessels are abundantly supplied with valves. In places there are **lymphatic glands** in the course of the lymph-vessels. These are bean-shaped structures in which there are very many white blood cells forming the so-called **lymphoid tissue.** In the lymph glands the lymph is altered, some substances being extracted from it, such as bacteria and poisons, while many white blood cells are added to the lymph as it passes through the glands, since these are centers for the multiplication of the leucocytes. Thus, when there is an infected wound present the lymphatic glands nearest to it take up the poisons produced in the wound and become inflamed, enlarged and tender. The bacteria arrested may set up suppuration and cause the formation of an abscess, so that for instance an abscess in the neck may result from an ulcerated tooth or from tonsillitis.

In order to understand the anatomy of the circulation, let us follow the blood through its course.

Impure blood enters the right auricle from the venæ cavæ; when full, the auricle contracts, forcing the blood into the right ventricle; as this fills, the tricuspid valve floats up and closes the opening into the auricle; the right ventricle now contracts and drives the impure blood through the pulmonary artery to the lungs, to be purified. **Pure blood** returns through the pulmonary veins to the left auricle; when the left auricle is full it contracts, and forces its contents into

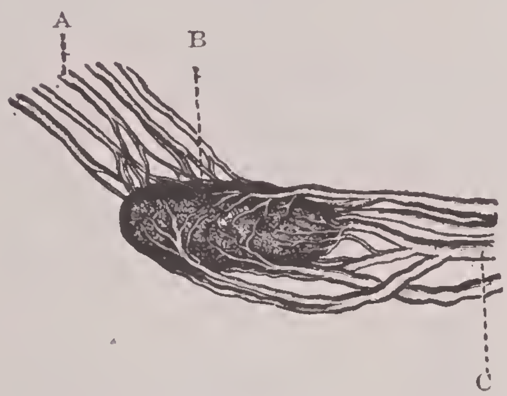


Fig. 29. A lymph gland, natural size. A. The afferent lymph-vessels which bring the lymph to the gland, B. In this it is altered and purified before it passes on into C. The efferent lymph-vessels by which it is carried back finally to the veins, where it mixes again with the blood.

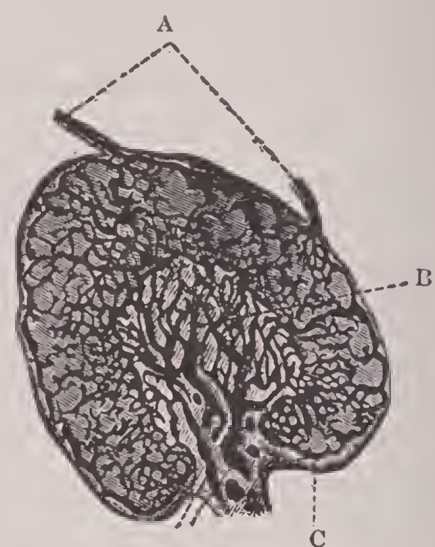


Fig. 30. Section through a lymph-gland showing how the afferent vessels, A, lead into a network of channels, B, within the gland. These collect into D, the efferent vessels, which carry the lymph on. C, fibrous covering of the gland.

the left ventricle; as this in its turn fills, the mitral valve closes, and the blood is pumped by the contracting ventricle into the aorta, and by its branches, into all the arteries of the body. It passes from the larger arteries into smaller and smaller vessels till the network of capillaries is reached. Here the blood does its work, giving up oxygen and other nourishment to the tissues, and picking up from them waste materials to be conveyed away and disposed of. In an impure state it now passes on into the smallest veins, and thus through larger and larger veins it reaches the vena cava, and so returns to the heart. It must be remembered that both sides of the heart **act together,** so that while impure blood is being purified in the lungs, pure blood is being pumped into the tissues.

It will be seen that the circulation of the blood in the body has a double course; there is

(a) **The Systemic or Larger Circulation**—the circulation through the arteries of the body by means of which pure blood is distributed to every part.

(b) **The Pulmonic Circulation**—the circulation through the arteries of the lungs by means of which the impure blood is purified.

The Work of the Heart.—Each heart-beat means a contraction of the whole of the muscular substance of the heart. This occurs, on an average, seventy-two times in a minute, or more than 100,000 times in a day. It is easy to see that the daily work of the heart is very considerable. During sleep the other muscles are resting and motionless; but the heart goes on all the time. The daily work of the heart is calculated by Foster to be equal to "the amount of work done in the ascent of Mount Snowdon by a tolerably heavy man." The heart, however, is not without rest. It **works** only while contracting (or during **systole**, as it is termed). It **rests** during **diastole** (or while filling), which is about half the time.

The Blood.

Function and Composition.—The life of the body and of its several parts depends on a regular and sufficient supply of healthy blood. If much blood be lost the whole body dies; an organ or limb dies if its blood-supply be cut off for some time. The blood is the carrier of the nourishment for the tissues, and contains all that they require, viz., **oxygen, water, proteids, carbohydrates, fat, salts.** The living tissues continually undergo chemical change, taking substances from the blood to **assimilate** or convert into the same kind of material that the living tissue consists of, and giving up waste products or used up material which has yielded up most of its energy during the activity of the tissues. . The waste is principally **urea** and **carbonic acid.**

The red color of blood is due to **hæmoglobin.** It has the property of combining loosely with oxygen (in the lungs) and of yielding it up again readily (in the tissues). Hæmoglobin contains much iron, to which this oxygen-carrying power is due. It is contained in the red corpuscles, which are therefore the **oxygen-carriers.**

The nourishing character of the blood is well shown by a comparison of its composition with that of muscle and of proteids.

	In Blood.	In Muscle.	In Hæmoglobin.	In Protein.
Carbon	52	52	54	51—54
Oxygen	21	21	21	21—23
Hydrogen	7.25	7.5	7	7—7.3
Nitrogen	15	15	16	15—17

Color.—Blood is bright scarlet when taken from an artery or after exposure to the air, dark purple or nearly black if drawn from a vein. It is very opaque.

Weight.—Blood is a little heavier than water. Its specific gravity is 1050, which means that 1000 cubic inches of it weigh as much as 1050 cubic inches of pure water.

Properties.—Blood is always **alkaline**—the opposite of **acid.** This is due to a salt called disodic phosphate, which has the chemical composition Na_2HPO_4. The most peculiar property is that of clotting. Soon after blood is drawn it becomes viscid or syrup-like in consistence and in a few minutes is jelly-like. This is termed clotting and is due to the formation of minute threads which form a fine network or sponge-like structure in which the blood corpuscles or cells are entangled. The threads are **fibrin** and contract in the course of a few hours into a firm **clot** which floats in a yellowish fluid, the **serum.** Unclotted blood consists of the **red** and **white blood cells** and the fluid **plasma** or **liquor sanguinis.**

The **Red Corpuscles** are oxygen-carriers. Every time an action is performed or a thought passes through the mind, each time a breath is drawn or the heart beats, some of the body tissues are used up. A constant wear and tear is going on; parts of the body are actually being consumed, or, as it were, being burnt up, and waste matters, or ashes, are continually being formed. This chemical change keeps up the heat of the body, and cannot take place without the presence in the tissues of a gas called **Oxygen,** which we obtain from the air around us.

Moderate warmth hastens clotting, as also do foreign bodies. Clotting is one of nature's ways of arresting bleeding.

The Red Blood Cells in human blood are very minute discs with hollow faces, hence described as **biconcave** discs. They are only $^3/_{10000}$ of an inch wide and $^1/_{10000}$ thick. There are 5,000,000 in 1 cubic millimeter of blood. In other words, a cube of blood $^1/_{25}$-inch on each side, contains 5,000,000 red cells! In the same volume there are 5,000 to 10,000 **white cells.** The number of the latter varies widely even in health and yet more in disease. The white cells are always more numerous after meals. These cells are not all alike and have the remarkable property of **amœboid movement.** In structure they are like a minute mass of jelly with a central denser part, the **nucleus.** The cell can protrude itself in an arm-like process on any side. Such a protrusion is called a **pseudopodium** and the whole cell may flow into it and thus change its location. This flowing is termed amœboid

movement from its similarity to the movement of a very low animal, the **amœba.** By this movement the white cells can engulf solid particles such as disease germs—this is termed **phagocytosis**—or again, the white cell may crawl through minute openings which they make in the walls of the blood capillaries—this is termed **emigration,** or **diapedesis.** The white corpuscles that have thus escaped from the bloodvessels may become **pus** in an abscess; or they may get into a healing wound, become a fixed cell and form part of the resulting scar; or again they may destroy disease germs; or finally they may aid in the absorption of fat, which they pick up on the inner surface of the intestine and carry into the tissues.

The **Leucocytes,** or colorless corpuscles, have two important duties. First, they act as **scavengers,** picking up and destroying germs of disease and other noxious particles; secondly, they limit the effect of injuries, and promote the healing of wounds. When a part is injured, crowds of leucocytes rush in from neighboring parts to the spot, and surround it as by a wall, so as to prevent the injury from spreading. After a while, some of these leucocytes change into fibrous tissue, and produce healing of the wound.

Fig. 31. Blood corpuscles or cells, magnified about 600 times. a, Human red blood cells. b, The same grouped in rouleaux (like rolls of coins) in stagnant blood. c, Human white blood cells. d, Red cells of elephant; e, of camel; f, of goat; g, of pigeon; h, of snake; i, of fish; and r, of frog. All are magnified the same, hence the relative sizes are shown.

Gases in Blood.—100 parts of blood contain 50--60 parts of **oxygen** and **carbon dioxide,** in part dissolved, but mostly in loose chemical combination. The oxygen with the hæmoglobin forming **oxyhæmoglobin;** the carbon dioxide, combined with soda, as carbonate and bicarbonate ($Na_2\ CO_3$ and $Na\ H\ CO_3$).

Blood in Disease.—Anæmia is the commonest blood disease. It results from copious bleeding or any prolonged or debilitating disease. Such blood is "thin," has a low specific gravity—1030--1040—the red cells are too few; the hæmoglobin deficient in amount; the water increased in proportion. Healthy and anæmic blood compare as follows:

	In Health.	In Anæmia.
Water	80	88
Solids	20	12
Specific gravity	1055	1035
No. of red cells per cubic mm...	4 to 5 millions	1 to 2 millions
Proportion of hæmoglobin.......	12%	1 to 2%

The deficiency is chiefly of the hæmoglobin or oxygen-carrying constituent. Hence shortness of breath is a marked symptom of anæmia.

In **leucocythæmia** there is an excess of white blood cells and the spleen or lymphatic glands are usually enlarged.

In **hæmophilia** there is a marked tendency to bleeding from very slight causes and it is very difficult to stop the flow of blood. Extraction of a tooth has been followed by death from uncontrollable hæmorrhage. A slight scratch may bleed for days. The disorder is hereditary and is transmitted by the female side of the parentage.

Amount of blood in the body.—The blood constitutes $^1/_{13}$ of the total body weight, or rather more than a gallon in an average individual. This contains about 500 grams of hæmoglobin, 450 grams of proteid and 2.5 grams of iron. It is distributed in the body nearly as follows: One-fourth in the heart, lungs and adjacent large vessels; one-fourth in the muscles; one-fourth in the liver; one-fourth in remaining parts.

Tests.—1. The microscope may show the characteristic cells; the size and shape of these may show the class of animal from which the blood comes; as bird, fish or mammal. 2. The **hæmin** test. The blood stain is scraped into a little water on a glass slide, heated with table salt and acetic acid (vinegar) till bubbles appear, and then examined under the microscope, which reveals the peculiar crystals of hæmin that form. 3. The **spectroscope** shows the spectra peculiar to blood and its derivatives.

The **lymph** is a clear fluid containing white, or colorless, corpuscles. It makes up nearly 30% of the body-weight. It is derived from two sources: 1. The liquid part of the blood and the white

blood cells pass out through the walls of the blood capillaries into the tissues and so into the lymphatic capillaries and vessels. 2. The villi or finger-like projections of the inner surface of the intestine take up liquids and fat from the bowel contents. The resulting **emulsion** or mixture of fat droplets in an otherwise colorless fluid is white, like milk, and is termed **chyle**; it is carried in lymphatic vessels to the large **chyle cistern**, thence by the **thoracic duct** to the large veins in the root of the neck. Here also the lymph from all over the body is poured back into these veins and so returned to the blood, whence it came. The white color of the lymphvessels of the bowel gained them the name **lacteals** (from **lac**, Latin for "milk"). This is well seen in an animal examined a few hours after a meal containing fat.

Circulation of lymph.—The forces which propel the lymph along towards the heart are: 1. The pressure under which it is forced out of the bloodvessels. 2. Accidental pressure from muscular movements and from the **pulse** or movement of the arteries. 3. There are many valves in the course of the lymph vessels which allow the lymph to pass only **towards** the heart. 4. In inspiration the lowered pressure within the thorax causes the lymph to be sucked into the thorax.

The Nerves of the Heart.—The heart, like every other muscle in the body, has a supply of nerves which control its action. This nerve-supply is twofold:

(a) Some of the nerves come from the **Vagus**, a large nerve passing out from the skull and sending branches to the respiratory and digestive organs, as well as to the heart. This set of nerves controls or **inhibits** the heart's action; they keep it in check, and prevent it from beating too quickly.

(b) Other nerves come from the **Sympathetic Chain**, which will be considered in a later chapter. These nerves tend to quicken the heart.

By a nice adjustment these two sets of nerves in health balance one another, keeping the heart's action regular, or modifying it to suit circumstances. In disease either of the sets of nerves may be thrown out of order, and the heart's action is thus upset.

Distribution and Regulation of the Body-Heat.—The body-heat is kept up by the combustion that is continually going on in the tissues. This, as we saw, is carried on by means of the oxygen which reaches them through the blood. The natural average temperature of the human body is between 98° and 99° F., more exactly 98.6° F.

The heat of any part of the body depends upon its blood supply: if from any cause this is cut off or much reduced the part grows cold.

The amount of heat in the body is regulated by a set of nerves passing to the muscular walls of the smallest arteries in the skin and lining membrane of the respiratory tract; these nerves are controlled by **Heat Centers** in the brain. When there has been a great deal of combustion, as after violent exercise, the body tends to become too warm; the nerves of the heat-regulating mechanism are called into play; the small bloodvessels of the surface expand, more blood flows through them and distends the capillaries; fluid exudes and is taken up by sweat glands in the skin, from which it pours as perspiration. By the evaporation of this fluid the body is cooled. Part of the heat is got rid of by the air which is warmed up in the lungs and which is breathed in greater amount in exercise or work than during rest.

When the body temperature tends to fall too low, the vessels of the surface contract, less blood passes through them, and less fluid exudes, so that there is a diminution of the loss of heat by perspiration.

The Respiratory System.

We have seen how essential is oxygen for the continuance of life. The main supply of this gas is the air around us, and the respiratory system is the set of organs concerned in the breathing in of this all-important substance. Air can enter the body in two ways—by the mouth and by the nose; these passages open at the back of the throat into the **Pharynx.** The air then passes into the **Larynx,** a cartilaginous box which can be felt in the front of the neck, and which is open above and below. The upper opening of the larynx is close to the root of the tongue, and is called the **Glottis**; between the glottis and the tongue is a spoon-shaped piece of cartilage, the **Epiglottis**; when food is swallowed, the epiglottis closes down over the glottis and prevents food from passing into the larynx. The largest cartilage in the larynx is named the **thyroid cartilage.** In man it forms a prominence in the front of the neck, termed "Adam's apple."

The whole larynx is lined with a membrane which, on each side of the glottis, is drawn into an elastic fold. These folds almost meet in the midline, leaving a narrow chink for the air to pass through; they are the **Vocal Cords.** Their tension can be altered by means of a wonderful arrangement of small muscles and cartilage; when they are made tense and brought close together, air passing through the larynx throws the cords into vibrations. This is **voice production** or **vocalization.** All vowels and some consonants are vocalized. Thus, in **zeal** "z" is vocalized; in **seal** "s" is not vocalized, otherwise

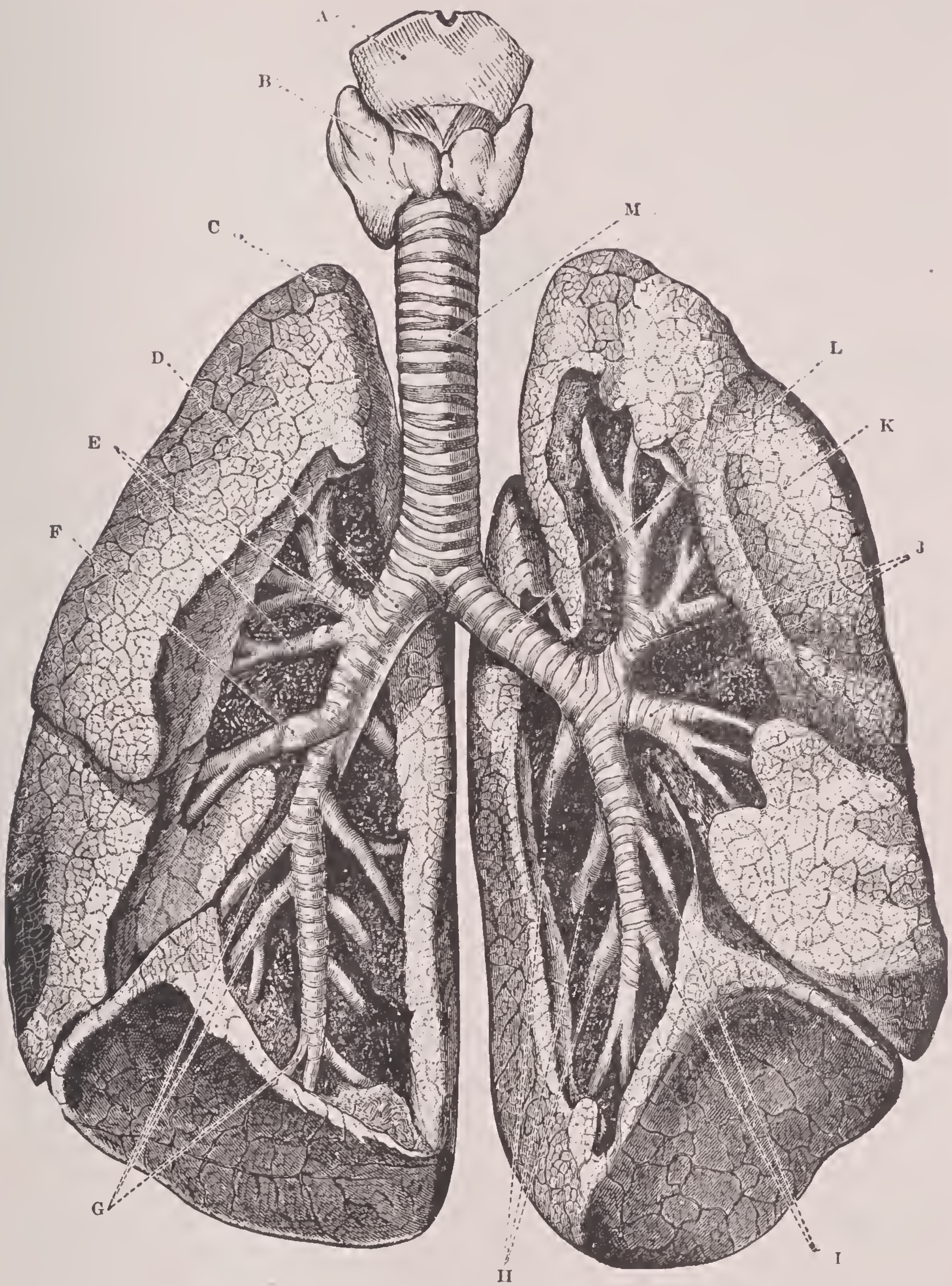


Fig. 32. The Lungs and Air Passages. Seen from in front. The left lung is turned outward to show its middle surface. The bronchial tubes and their branches are shown by removal of a part of the lung substance.

A, Larynx or voice-box. B, Thyroid gland. C, Apex of the lung. D, Right bronchus. E, Its branches to the upper lobe of the lung. F, To the middle lobe. G. To the lower lobe. H, I and J. Branches of the left bronchus, L. H and I, to the lower, and J, to the upper lobe. K, Middle or internal face of the lung. M, Trachea or windpipe. The dark bands on it are the cartilage rings.

zeal and seal are the same. By changes in the tension of the cords the different tones of the voice are produced.

The lower end of the larynx opens into the **Trachea,** or windpipe, a tube strengthened by horseshoe-shaped pieces of cartilage which can be felt in the lower part of the neck. The open part of the horseshoe is directed to the back and the toe, or closed part, is just under the skin in the front of the neck. The series of rings gives the name "trachea" or **"rough artery."** The trachea is about 4 inches long, and passes down into the chest.

Here it divides into two branches, the **Right and the Left Bronchus,** one of which passes to each lung. On entering the lung, the bronchus divides again and again, its branches becoming ever smaller and thinner walled, and ramifying all over the lung. The smallest branches of all open into the air cells of the lung.

The air passages are lined with a layer of cells, each studded with fine hairlike processes, projecting fingerlike into the cavity of the tube. These fingerlike projections are called **Cilia** and they are continually moving backwards and forwards. They have the power of sweeping dust and foreign particles breathed in with the air, outwards and upwards, and so prevent a great deal of injurious matter from reaching the delicate air cells.

The **Lungs** are two in number, the right and the left. They occupy the greater part of the thorax; they are larger below than above, where they taper to a blunt apex.

Each lung is encased in a double bag of membrane, the **Pleura,** of which one layer covers the lung and the other lines the cavity in which the lung is situated. The two lungs together weigh about 40 ounces. The substance of the lungs is spongy, porous, and very elastic; they float in water, owing to the air which they contain. Each contains myriads of minute **Air Cells,** in the walls of which is a network of capillary bloodvessels. These capillaries are the outcome of the branching of the pulmonary artery, and they unite to form the small veins which, by further union, ultimately become the pulmonary veins. The walls of the air cells are so thin that an interchange of gases can take place between the air in them and the blood in the capillaries. Oxygen passes into the blood from the air cell, and is seized by the red corpuscles; while carbon dioxide passes into the air cell from the blood and is breathed out.

A healthy adult breathes in and out from sixteen to twenty times per minute, about 25,000 times in twenty-four hours, and requires 3,000 cubic feet of air per hour. About 30 cubic inches of air is taken

in and given out in each breath. This can be increased by an effort of will to 130 cubic inches in and out. After the fullest possible expiration there still remains in the lungs about 100 cubic inches of air.

Composition of Air.—Inspired Air, that which we breathe into our lungs from the surrounding atmosphere, is a mixture of gases, the two most important of which are **Oxygen** and **Nitrogen.**

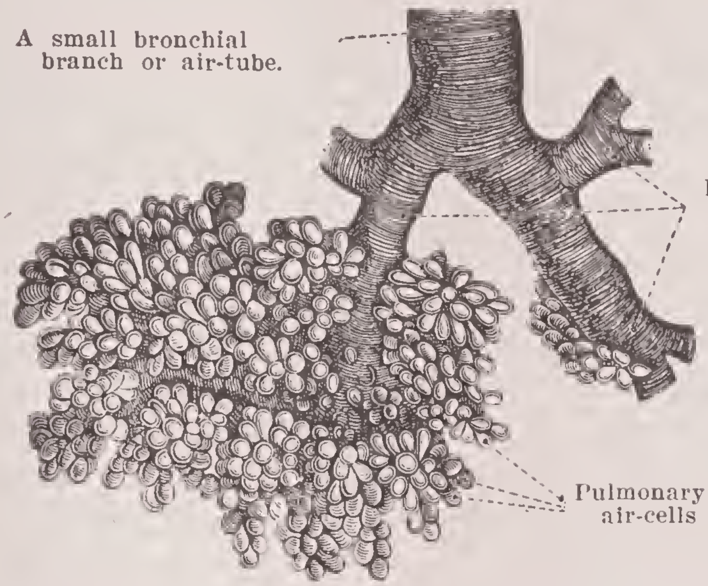


Fig. 33. A mould or cast of the air-tube and cells in a very small piece of the lung, enlarged ten times. Only the spaces are here represented. The walls enclosing these have very numerous blood vessels in which the blood becomes purified by interchange of carbon dioxide for the oxygen of the air in the air-cells.

Oxygen, as we have seen, is a vital necessity; the body cannot live for even a few minutes without it; and it obtains it from the air. Nitrogen is just as necessary to life as oxygen; but although we take it in in the air we breathe, the atmospheric nitrogen is not used up in the body; it returns in practically the same amount as it entered. We get the nitrogen we require from other sources than the air. Its use in inspired air is to dilute the oxygen to the proper proportions. Besides these two gases, traces of other substances are found, among them carbon dioxide, which in good air occurs in very small proportion.

Expired Air, which we breathe out from our lungs, contains the same gases, but in very different proportions, and is also **saturated with moisture** and is warmer.

If we take 100 volumes of inspired air and compare it with 100 volumes of expired air, we shall find the proportions of the constituents to be roughly as follows:

	Inspired Air.	Expired Air.
Oxygen	20.81 vols.	16.033 vols.
Nitrogen	79.15 vols.	79.587 vols.
Carbon dioxide	.04 vols.	4.38 vols.
	100.00 vols.	100.000 vols.

This table shows that about one-fifth part of the oxygen breathed in is used up in purifying the blood. We also see that the nitrogen is breathed out in almost the same proportion as it was breathed in. The greatest change is in the carbon dioxide, of which there is more than 100 times as much breathed out as was breathed in. The air breathed out is also saturated with moisture, as can be seen by breathing on a cold surface, like a window pane, when a film forms. These two substances, carbon dioxide and water, are two of the products of combustion continually proceeding in our bodies. They are, in fact, waste materials, or ashes; and the lungs are one of the channels by which these waste products leave the body; such a channel is known as an **Excretory Organ.** The most important of the excretory organs are the **lungs, kidneys** and **skin.**

Carbon dioxide is a poisonous gas; it is a narcotic poison, **i. e.,** makes one sleepy and insensible; a candle cannot burn in an atmosphere of carbon dioxide; and when this gas reaches to a certain proportion in the air, as in a crowded, stuffy room, where people have been breathing the same air over and over again, symptoms of poisoning arise, such as headache, oppression, giddiness, and faintness. This poisonous effect is produced not only by the carbon dioxide, but also, and to a greater extent, by the presence in the expired air of certain **animal poisons** given off from the body through the lungs.

How the Human Engine Produces Heat, Energy and Force

Subject Reference

For Process of Digestion see Vol. 1, pages 107 to 147.

For Diseases of the Stomach see Vol. 2, pages 399 to 407.

For Diseases of Intestines see Vol. 2, pages 409 to 419.

Note:—The Stomach is just like a Fuel Box and a Boiler. Your Stomach will make Steam and Heat, Feeding Energy and Vitality to Your Body. Keeping Your Brain Active and Bright Providing it has the Right Fuel.

The Organs of Digestion and Excretion.

Our daily life involves a continual giving out of heat and using up of energy and force. This double process means a constant wear and tear, an actual consumption of material, and obviously demands a constant renewal of the sources of energy and heat. **Food** is the means whereby our bodies are repaired and maintained. It has been found that, in order to keep the body in an active and efficient state, we require certain definite kinds of food in certain proportions.

The foodstuffs that we need are of four classes:

1. **Nitrogenous Foods,** or **Proteids,** which contribute to the growth and nutrition of the tissues, and provide some amount of heat and force. The commonest sources of nitrogenous or proteid food are lean meat, fish, white of egg, casein (the chief constituent of cheese, hence also in milk), oatmeal, beans, peas.

2. **Carbohydrates** are used for the formation of fat and the production of force and heat. They are present in sugar and starches, such as bread, potato, cereals.

3. **Fats** are applied to the production of heat and other forms of force. We obtain them in the form of butter, cream, and animal and vegetable fats and oils.

4. **Mineral Matter,** including water, iron, lime, phosphorus, and various salts.

Water forms two-thirds of the body weight, and is found in every tissue. Water dissolves the food, and carries it all over the body. Food cannot be digested before it is dissolved.

Iron is needed to form the coloring matter of the blood, as well as the essential part of any living cell, e. g., the muscles; lime is essential to bone formation.

If the food were to be cast into the blood in the state in which it was eaten, it could not be used by the tissues. It needs to be acted upon and changed in many ways by the organs of digestion before it can be absorbed by the blood and used in the body. The whole of the digestive tract is lined with a **membrane**, through which the food must pass before it can reach the blood and be carried to the tissues. The foodstuffs as we take them into our mouths are, for the most part, not in a state to pass through this membrane; they are said to be **non-diffusible.** They must be acted upon by the different organs of digestion and the various digestive juices, and so changed as to become **diffusible, or capable of passing through the lining membrane of the digestive tract.** This process of changing non-diffusible substances into diffusible ones is **Digestion.**

During life the activities of the body produce a great deal of waste material, which must be eliminated from the body if health is to be good. The process of ridding the body of waste matter is known as **Excretion.**

The Organs of Digestion.

The processes of digestion are carried on in a canal, which begins at the mouth, passes through the neck and trunk, and ends at the anus.

The first process to which the food is subjected is **Mastication.** This is carried on by the **Teeth,** which in an adult should number thirty-two, viz., in each half of each jaw 8, or 2 **incisors** or cutting teeth, 1 **canine, 2 bicuspids and 3 tricuspids, molars** or **grinders.** The ones farthest back are the **wisdom** teeth, since they usually appear at 20 to 25 years of age. The **tongue** plays an important part in shifting the food about and holding it between the teeth. By the teeth the food is thoroughly ground up and broken into small fragments, so that it can better be exposed to the action of the digestive juices.

During the process of mastication the food comes into contact with the first of the digestive fluids, the **Saliva.** This is a clear fluid, poured into the mouth by three pairs of glands, viz., the **parotid,** situated in the cheeks; the **submaxillary,** below the jaw, and the **sublingual,** below the tongue. The saliva has three uses:

1. It moistens food and aids swallowing.
2. It dissolves some of the minerals and salts.
3. It acts specially upon the starchy part of the food, which is non-diffusible, and converts it into **Grape-sugar,** which is diffusible. The active principle of saliva is a substance called **Ptyalin,** which belongs

to a class of bodies known as **Ferments**. These have the property of accelerating chemical changes, **e. g.**, the transformation of starch into sugar.

The food, now ready to be swallowed, is formed by the muscles of the mouth and tongue into a rounded ball, and passes into the **Pharynx** or throat, from which it passes down into the gullet,

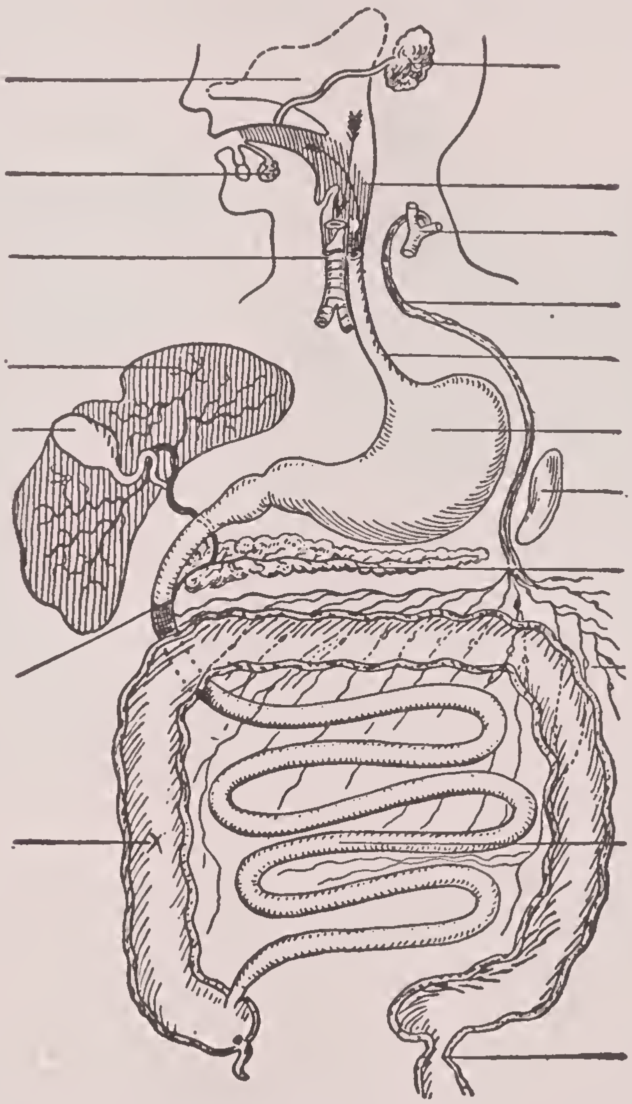


Fig. 34. A diagram of the parts of the digestive system. The arrows show how the air-tract crosses the food tract in the pharynx or throat.

or **Œsophagus**—a muscular tube passing down the neck into the thorax, through an opening in the diaphragm, to open into the stomach, situated under the heart, below the diaphragm, in the left upper part of the abdomen.

The **Stomach** is a muscular bag, capable of holding about 3 pints; it can be distended or stretched. Its muscular walls are composed of plain (unstriped) fibers. It is lined by a mucous membrane, which is studded with small glands; these glands secrete a fluid called **Gastric**

Juice, a watery fluid which contains **pepsin, hydrochloric acid** and **mucus.** When the food enters the stomach two things happen: (1) The muscular walls of the organ begin to contract; (2) the gastric juice begins to flow in and mix with the food.

By the former process, the food is still further divided and ground; this occupies from one to four hours, and by this time the food becomes converted into a greyish, thick, soupy mass called **Chyme.**

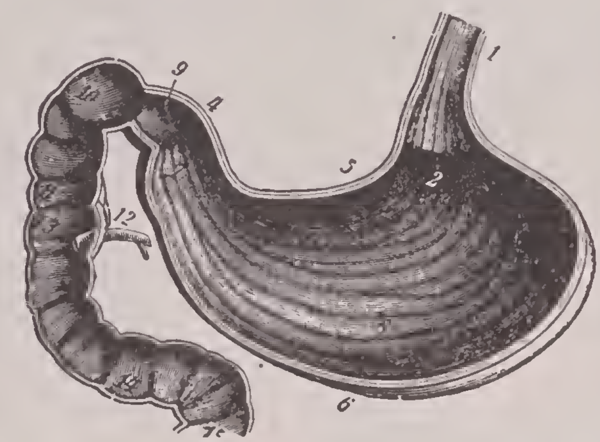


FIG. 35. THE STOMACH DIVIDED LENGTHWISE.

1, Gullet or œsophagus. 2, Beginning of the stomach. 3, Fundus. 4, Pyloric part. 5, Lesser curvature. 6, Greater curvature. 7, Entrance to pylorus. 8, Cavity of the stomach, lined by the mucous membrane which is wrinkled if the stomach is not full. 9, Pylorus, or exit from the stomach; it is closed except when the partly digested food passes on out of the stomach. 10, Upper part, 11, middle part, and 14, lower part of the duodenum, or first part of the small intestine. 12, Ducts of the liver and pancreas. 13, Their opening into the bowel. 14, The jejunum or second part of the small bowel.

All the time the action of the stomach has been going on, the food is prevented from passing freely on into the small intestine by the narrowing of the opening between it and the stomach. This opening is the **Pylorus,** and only allows the food to pass through little by little (see Chapter I of Food in Common Complaints) when the stomach has done its work.

The second process—the admixture of gastric juice with the food—produces important changes in the nitrogenous or proteid part of the meal. **Proteids** are non-diffusible substances; gastric juice contains a ferment, **Pepsin,** which can convert proteids into diffusible **Peptones.**

Having passed through the pylorus, the food now enters the **Small Intestine.** This is a tube, 20 feet in length, coiled upon itself in a complicated manner, and occupying a large part of the abdomen. The first 12 inches of it are known as the **Duodenum**; the next 7 or 8 feet are called the **Jejunum**; and the rest is the **Ileum.** This opens into the **Large Intestine.** Into the duodenum opens a little canal, which conveys the secretions of the liver **(bile)** and pancreas (pancreatic juice).

The **Liver** is the largest gland in the body, and weighs between 3 and 4 pounds. It is situated in the right side of the abdomen, below the diaphragm, and under cover of the ribs. It secretes a digestive

juice, the **Bile,** the use of which is principally to aid the action of the pancreatic secretion. It is in part **excretory,** i. e., waste material.

The **Pancreas** is known as the "belly sweetbread" in the lower animals used for food. It is a gland lying across the spinal column behind the stomach. Its secretion is known as **Pancreatic Juice,** and is very important, as it acts very vigorously on proteids, carbohydrates and fats. On **proteids** it acts like gastric juice, finishing off the conversion of them into peptone which was begun in the stomach;

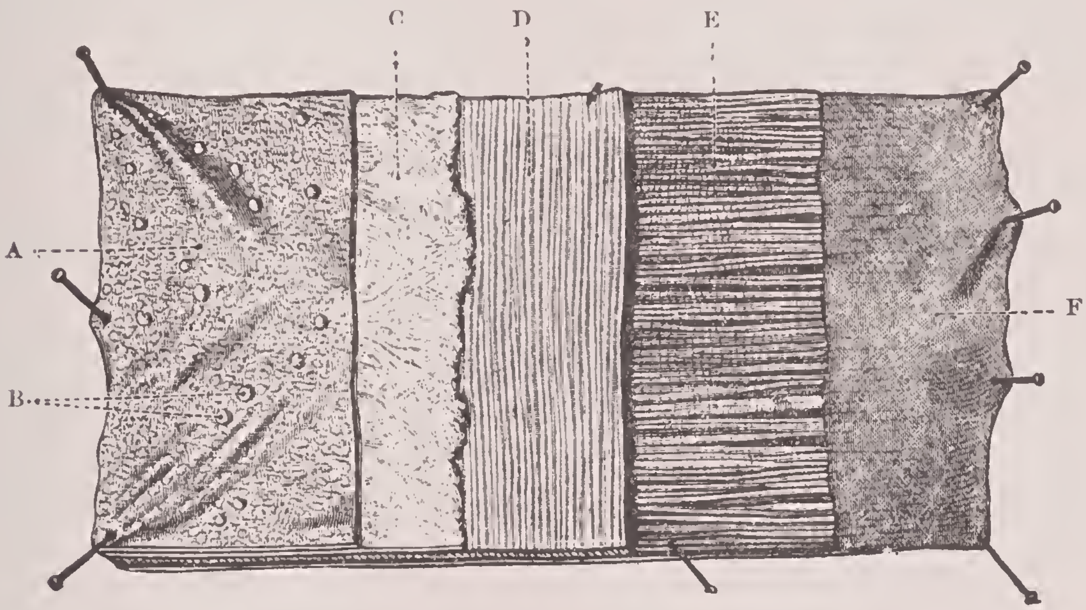


Fig. 36. The layers of tissue forming the wall of the small intestine, as seen in a short piece laid open and with parts dissected away. A. Mucous coat or lining layer. B. Lymph nodules in it. C, The loose, submucous coat. D, The layer of circular muscle. E, The layer of longitudinal muscle. F, The peritoneum or outer coat of the intestine.

this is done by a ferment called **Trypsin,** and this substance carries the digestion of proteids further than does pepsin, for it separates out from them certain waste substances which are not absorbed, but pass away with the other indigestible portions of the food.

On **starch** (carbohydrate) it acts like saliva, but far more rapidly and energetically; saliva only converts part of the starch into grape sugar; pancreatic juice finishes off the process, converting the remainder of the starch into **malt sugar.**

On **fats,** pancreatic juice, helped by the bile, acts with great vigor, **emulsifying** them—that is, breaking them up into very minute particles, thus forming an **emulsion** or milklike fluid. This is a necessary prelude to their absorption, for large fat droplets cannot pass through the lining membrane of the digestive tract, whereas the tiny droplets of an emulsion can do so. The fat is in part split up chemically into **glycerine** and fatty acids. These are fluids and are absorbed as such and then recombined into fats. Some of the fatty acids are com-

bined with soda and potash to form soap, which is readily absorbed.

By the action of the bile and pancreatic juice, the food becomes converted into a creamy fluid, the **Chyle.** In this condition it passes along the small intestine, being forced onwards by peculiar wormlike contractions of the tube, whose walls are muscular; this is known as **Peristaltic Action.** Absorption takes place chiefly from this part of the digestive tract.

Absorption.—The chyle consists of a mixture of diffusible substances—peptones, sugars, and fats in a state of emulsion. This state of affairs has been brought about by the action of different digestive juices upon the non-diffusible proteids, starches, and fats.

In the walls of the intestine are found three sets of vessels—arteries, veins, and lacteals.

The **Arteries** are branches of a large trunk coming from the aorta, and contain pure blood to nourish the muscular wall of the tube and its lining membrane and to supply the glands in the latter.

The **Veins** are small vessels, which take a large share in the absorption of food. In the walls of the stomach they begin their work, taking up water and dissolved salts, and as much of the nitrogenous food as has been converted into peptone, also the sugars formed by the action of the saliva on starch. In the intestine, the veins receive through the lining membrane the rest of the peptones and sugars, water and salts. These small vessels unite into larger ones. By the union of large veins from the stomach, intestine, pancreas, and **spleen** (an organ situated on the left side of the abdomen behind the stomach and concerned in the work of purifying and renewing the blood cells), there is formed a very large vessel known as the **Portal Vein.** This passes to the liver, and forms by its branchings a network throughout that organ. These branches of the portal vein divide finally into capillaries, which in turn unite to form veins that carry the blood out of the liver. The blood which reaches the liver by the portal vein is rich in nourishment, containing as it does all the products of digestion except the fats. The sugar is stored up in the liver in the form of **glycogen,** to be served out to the body as it is required. The blood, having passed through the network formed by the branchings of the portal vein, leaves the liver by the **hepatic veins,** which open into the inferior vena cava; in this way the nitrogenous part of the food, the salts and water reach the heart, to be pumped to every part of the body.

Peptones are poisonous if injected into the blood; they are not found in it. The nitrogenous material in the blood is proteid. On

their way from the inside of the digestive canal through to the inside of the bloodvessels, the peptones seem to be converted once more into proteids.

The **Lacteals** are small vessels, into which pass the minute particles of the emulsified fats. They have, when full, a milky appearance. They unite into larger vessels, and ultimately form a trunk known as the **Thoracic Duct,** which, passing up the thorax close to the spinal column, opens into a large vein in the neck, and pours the fatty portion of the food into the blood stream.

We have seen that the food, having undergone remarkable changes in the digestive tract, passes into the blood stream, and is thus distributed to the rest of the body.

The small intestine opens into a wider tube, the **Large Intestine,** at the lower part of the abdomen on the right side. The junction is guarded by a valve, the **ileocæcal valve,** which prevents the contents of the large bowel from passing back into the small bowel. This portion of the digestive canal is much wider and less coiled than the small intestine; it is divided into four parts, the first of which, the **Ascending Colon,** passes upwards on the righthand side of the abdomen to the liver, then bends to the left, coursing across the body to the stomach; this horizontal part is the **Transverse Colon**; on the left side of the abdomen, close to the spleen and stomach, the transverse colon bends downwards and becomes the **Descending Colon,** which passes down on the left side of the abdomen to the pelvis. The part of the large intestine occupying the pelvis is known as the **Rectum,** and the canal ends by an opening, the **Anus.**

A certain amount of absorption takes place in the large intestine, but much less than higher up in the digestive tract. The contents of the larger bowel are more solid than in the small intestine, and consist largely of the parts of the food which cannot be digested, and which pass away from the body as the fæces or stool.

Excretion.

The food, changed by digestion, is absorbed, and carried by the blood stream to the tissues. Here the various constituents of the food are converted into bone, muscle, fat, etc. During the activities of the body, these complex bodies are broken up into simpler substances, the most important of which are water, carbon dioxide, mineral matter, and **urea**—a nitrogen-containing substance which is the result of decomposition of the nitrogenous parts of the body. Nitrogen enters the body as proteid, and leaves it as urea.

These waste matters are picked up from the tissues by the blood, and are carried away to the three main channels of outlet:

1. The **Lungs** get rid of most of the carbon dioxide and large quantity of water. This action of the lungs has already been studied.

2. The **Skin** serves as a channel for the discharge of a small quantity of mineral matters (salts), a little carbon dioxide, and a variable quantity of water, in the form of perspiration, which may evaporate as fast as it is formed (insensible perspiration) or may first gather as drops on the surface (sensible perspiration).

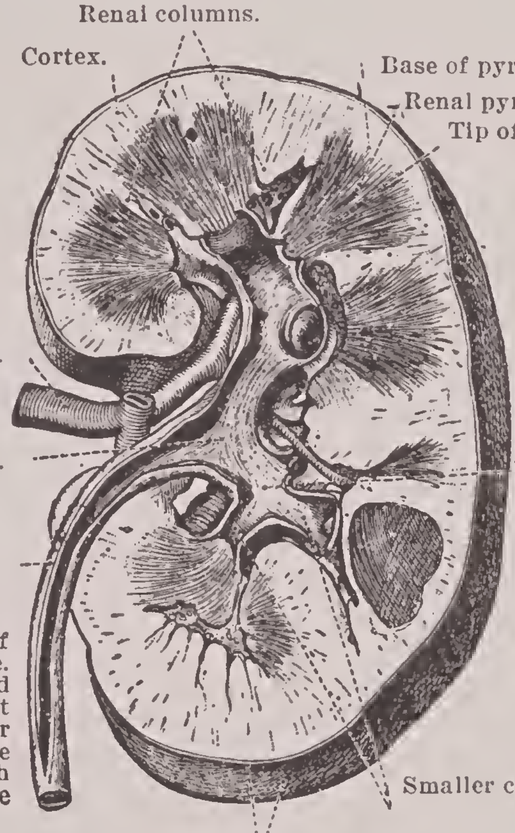


Fig. 37. The posterior half of the right kidney, ¾ natural size. The renal artery carries blood into the kidney. The vein is not shown. The calices (singular *calyx*) collect the urine into the pelvis of the kidney, from which it passes, by the ureter, to the urinary bladder.

3. The **Kidneys** discharge the urea, most of the mineral matter (salts), and a large quantity of water.

There is thus a division of labor amongst the excretory organs in health. In disease of any one of them, extra work is thrown upon the other two, and the body in general suffers.

The Integument or Skin.

The **Skin** is composed of two layers: the **epidermis,** or cuticle, and the **cutis vera**, or true skin. The epidermis is made up of a number of layers of cells, the deepest ones being soft and columnar in

shape, and the more superficial ones horny, hard, and flattened into scales. These are being continually shed or rubbed off, and their place is taken by the underlying cells. The deepest layer of cells can divide and multiply to supply the place of those lost or cast off. The cutis is composed of dense tissue, and contains nerves, blood-vessels, and glands.

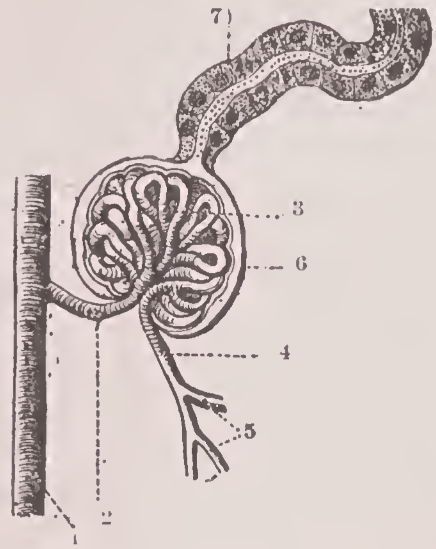


Fig. 38. A Malpighian corpuscle of the kidney. The blood coming from the artery of the kidney in one of its branches, 1, passes through, 2, the small *afferent artery* into 3, the bunch of little capillaries forming the *glomerulus*, 3. The blood is carried out of the glomerulus by the *efferent artery*, 4, which breaks up into capillaries, 5. The *renal tubule* begins as a thin-walled space, 6, surrounding the glomerulus and continued in the tubule proper, 7. The water of the urine comes from the renal corpuscles (of which there are many thousands in each kidney), while the solids dissolved in the urine are secreted by the cells of the tubule. In Brights' disease, the albumen of the blood passes out with water from the glomerulus owing to disease of the latter.

The **Hair** and **Nails** are derived from the epidermis, and are simply modifications of it.

The **Glands** of the skin are of two kinds: the **Sebaceous Glands** and the **Sweat Glands. Sebaceous Glands** are minute saclike bodies, which secrete an oily material. They open close to the roots of the hairs; their secretion nourishes the hairs and keeps the skin soft and flexible.

The **Sweat Glands** are found over the whole skin, but are most numerous on the palm of the hand and the sole of the foot. Each consists of a coiled-up tube, lying in the deeper part of the true skin, and opening by means of a corkscrewlike channel onto the surface of the epidermis. From these openings, which are called the **Pores of the Skin**, is continually passing a certain amount of water vapor. The sweat, or perspiration, consists of about ninety-nine parts of water to one part of solid matter (salts of different kinds). The amount of sweat varies greatly according to the amount of water taken into the system and the amount which leaves the body by the lungs and kidneys; it has been calculated to average about two pounds in twenty-four hours for an adult. In evaporating, the sweat takes up much heat and so cools the body much or little according to the amount of sweat.

The following Table shows the Processes of Digestion, Absorption, and Excretion.

Non-diffusible Food-Stuff.	*Diffusible Product of Digestion.*	*Digestive Organ and Fluid concerned.*	*Chief Uses.*	*Mode of leaving the Body.*
1. PROTEID. *Sources:* Meat, fish, eggs (white), cheese or milk (casein).	Peptone.	1. Stomach, gastric juice (pepsin). 2. Small intestine and pancreas, pancreatic juice (trypsin), aided by bile and intestinal juice.	Forms new tissue. Repairs waste. Provides some heat and force.	1. By the KIDNEYS, as *urea* and *water.* 2. By the LUNGS, as *water* and *carbon dioxide.* 3. By the SKIN, as *water.*
2. CARBOHYDRATES. *Sources:* Starch of bread, potato, etc.; cane-sugar.	Sugar of the grape-sugar and malt-sugar class.	1. Mouth, saliva (ptyalin). 2. Small intestine, pancreatic juice (amylopsin).	Form fat. Provide heat and force.	1. By the KIDNEYS, LUNGS and SKIN, as *water.* 2. By the LUNGS, as *carbon dioxide.*
3. FATS. *Sources:* Milk, butter, cream, fat of meat; animal and vegetable oils.	Emulsion of fat, glycerine, fatty acids, soaps.	Small intestine, pancreatic juice and bile.	Provide heat and force.	The same as carbohydrates.

By evaporation of the sweat from the surface the body is cooled and the temperature is regulated.

The **Kidneys,** two in number, are situated close to the spinal column in the upper part of the abdomen. Each is about 4 inches long, and 5½ ounces in weight. They have the power of abstracting from the blood that reaches them by the **renal arteries** the urea and most of the mineral salts which are formed during the body activity. Between two and three pints of water are discharged daily by the kidneys. The excretion of the kidneys—**Urine**—passes down from each of these organs by a tube—the **Ureter**—opening below into the **Urinary Bladder,** which is situated in the lowest part of the abdomen. This is emptied from time to time through a single canal, the **urethra.** The walls of the bladder are very muscular, but are ordinarily passive and released, but the **neck of the bladder,** or beginning of the urethra, is contracted. When the urine is voided, which act is termed **micturition** or **urination,** the muscular walls of the bladder contract and the neck of the bladder relaxes and the urine is thus forced out. In disease this control of the bladder may be lost. It is also lacking in young children.

Average Weight of the Various Organs.

	Male.	Female.
Brain	49½ oz. avoir.	44 oz. avoir.
Cerebrum	43 oz. 15 dr.	38 oz. 12 dr.
Cerebellum	5 oz. 4 dr.	4 oz. 12½ dr.
Pons and Medulla Oblongata	0 oz. 15¾ dr.	1 oz. ¼ dr.
Spinal Cord	1 oz. 5 dr.	1 oz. 4 dr.
Heart	11 oz. 0 dr.	9 oz. 0 dr.
Lungs, right	24 oz. 0 dr.	17 oz. 0 dr.
Lungs, left	21 oz. 0 dr.	15 oz. 0 dr.
Thyroid Gland	1 oz. 0 dr.	2 oz. 0 dr.
Liver	53 oz. 0 dr.	45 oz. 0 dr.
Pancreas	3 oz. 0 dr.	3 oz. 3 dr.
Spleen	6 oz. 0 dr.	5 oz. 0 dr.
Kidney	5½ oz. 0 dr.	5 oz. 0 dr.
Suprarenal Capsules	0 oz. ¼ dr.	0 oz. ½ dr.
Prostate	0 oz. 9 dr.	
Testis	1 oz. 0 dr.	
Uterus (Virgin)		7 to 12 dr.
Ovary		1 to 1½ dr.

Subject Reference

For General Principles of Nervous System see Vol. 1, pages 148-170.

Diet for Nervous Prostration, Vol. 1, pages 334-335.

For Diseases of the Nervous System, see Vol. 2, pages 427-456.

For Injuries of Nerves. Also Neuralgia and Sciatica, see Vol. 2, pages 93-96.

Structure, Uses and Functions of The Nervous System and the Organs of Sense

Feeling—Tasting—Smelling—Hearing—Seeing

How the Nerves Regulate and Control the Body, Conveying Impulses like Telegraph Wires to the Brain, Bringing All Parts of the Body Into Harmonious Unity and Placing the Body in Communication with Its Surroundings.

The Nervous System.

The nervous system regulates and controls the whole of the rest of the body. No part can fulfil its functions unless its nerve supply is in working order. It also correlates the parts of the body, or brings them into a harmonious unity, and puts the body in communication with its surroundings or **environment.**

The **Nervous System** consists of a **Central Portion**, the brain and spinal cord, from which branches, the **Nerves**, pass away to every part of the body. Nervous impulses pass along a nerve in one of two directions:

1. **From the Brain** to distant parts, when they are called **Efferent** impulses (going out from).

2. **To the Brain** from distant parts, when they are called **Afferent** impulses (going towards).

Nerves transmitting efferent impulses are sometimes called **Motor** nerves, because they go chiefly to muscles and produce motion. Nerves transmitting afferent impulses are called **Sensory,** because they convey to the brain impressions from organs of sense, which mostly become sensations.

Besides the brain, spinal cord, and nerves, the nervous system comprises bodies known as **Ganglia,** which are connected with the nerves in various parts; they look like swellings on the nerve, and have to do with the control and regulation of nervous impulses.

The whole nervous system consists of threadlike **Fibers** and of **Cells.** Each fiber is a prolongation from a cell. Fibers are found in the nerves, and, like telegraph wires, convey impulses to or from the central part along the nerve trunk. They also compose the larger part of the central portion of the nervous system, where their

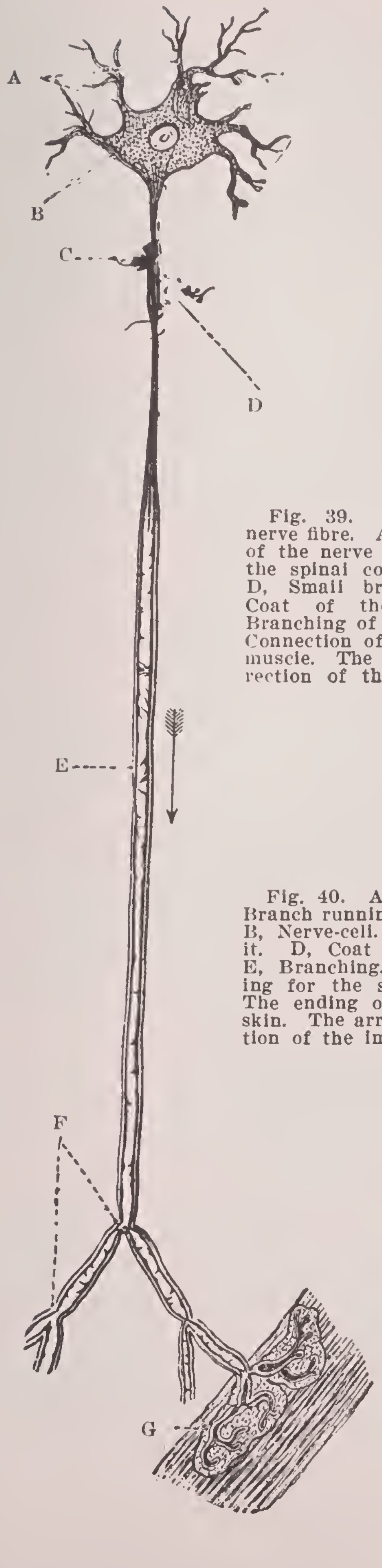


Fig. 39. Diagram of motor-nerve fibre. A, Tree-like processes of the nerve cell, B, which is in the spinal cord. C, Nerve fibre. D, Small branch from it. E, Coat of the nerve fibre. F, Branching of the nerve fibre. G, Connection of the nerve with the muscle. The arrow shows the direction of the nerve-impulse.

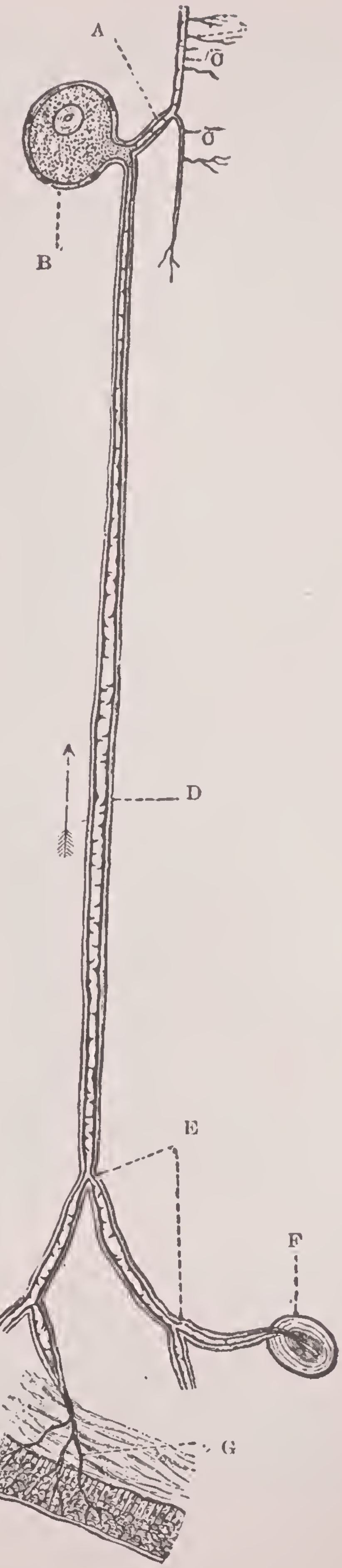


Fig. 40. A sensory nerve. A, Branch running up in spinal cord. B, Nerve-cell. C C, Branches of it. D, Coat of the nerve fibre. E, Branching. F, A nerve ending for the sense of touch. G, The ending of the nerve in the skin. The arrow shows the direction of the impulse.

white, glistening appearance gives this part the name of **White Matter.** The cells, on the other hand, are rarely found in nerves, except at their termination, but are confined chiefly to the brain, spinal cord, and ganglia. They make up what is known as **Gray Matter.**

The **Central Nervous System** is contained within the skull and the neural canal of the vertebral column. It consists of two halves, the right and the left, united by white and gray substance passing

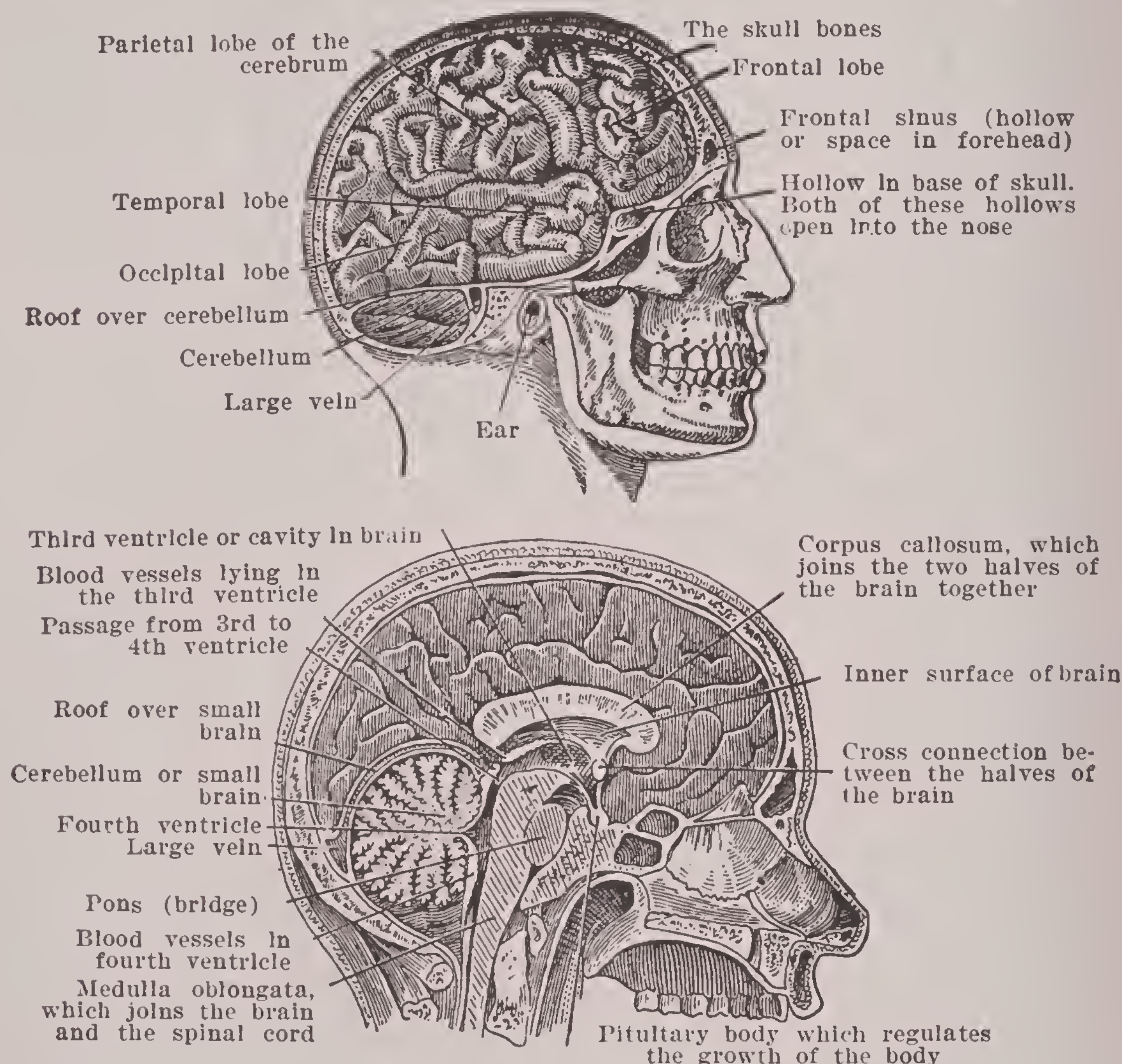


Fig. 41. The brain as seen within the skull.

from one side to the other. It is surrounded both within the skull and also within the neural canal by three protective and nourishing membranes, between which are spaces filled with clear fluid; this fluid, the **cerebrospinal fluid**, acts as a buffer and protects the delicate nervous structures from mechanical violence in falls, blows, jumping or even walking.

The outermost of these membranes is the firm, tough **Dura Mater,** next to the bone; then comes the delicate **Arachnoid**; and, thirdly, closely applied to the surface of the brain and cord, and dipping into all their hollows and irregularities, is the **Pia Mater,** full of blood-vessels, to nourish the nervous tissue.

The **Brain** is situated in the skull. It is the organ in which the processes of bodily and mental activity originate, and which receives and interprets all impressions from the organs of sensation. It weighs about 40 ounces, and is divided into **Cerebrum**, or large brain;

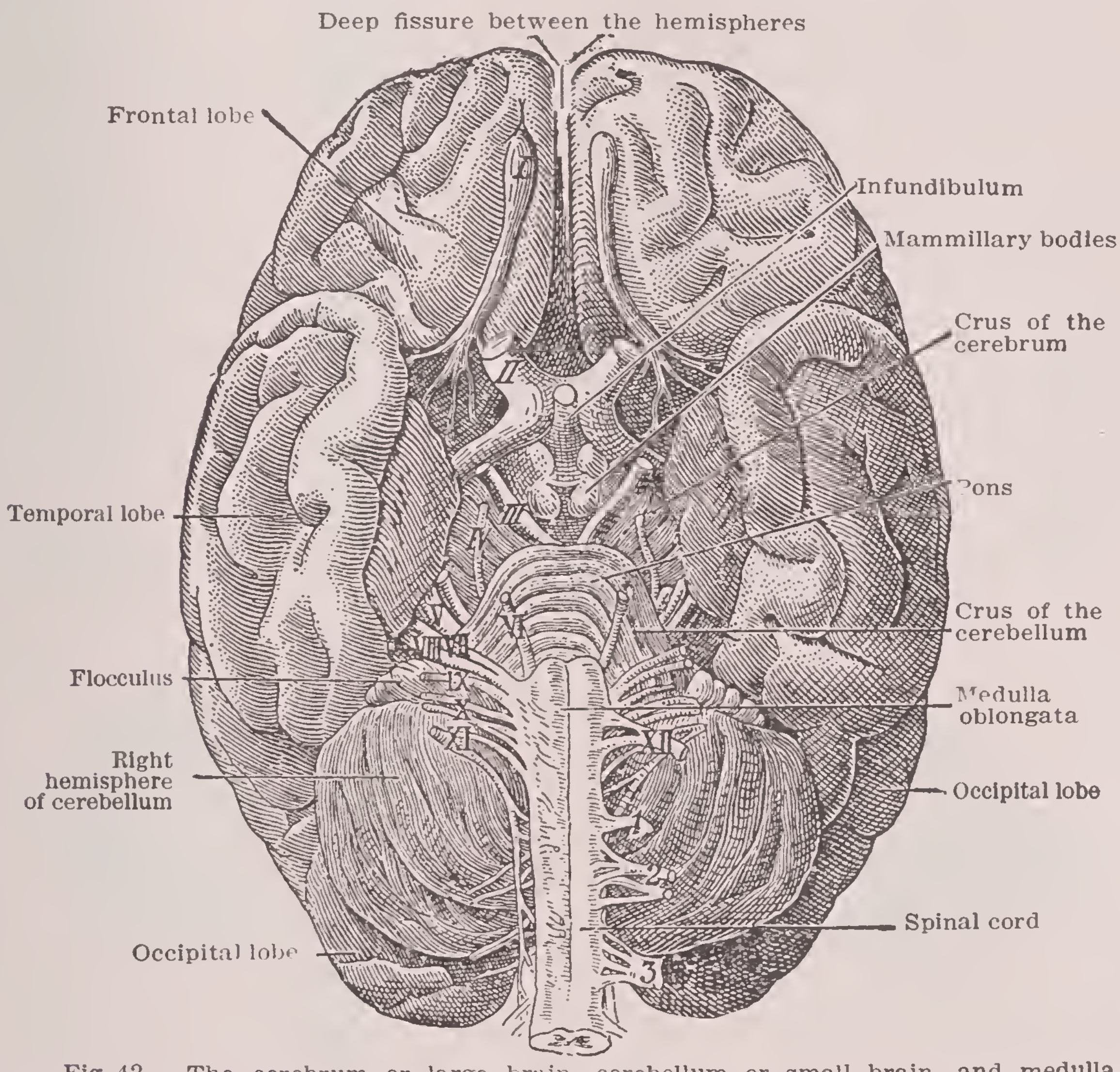


Fig. 42. The cerebrum or large brain, cerebellum or small brain, and medulla oblongata, as seen from below, showing the base or under surface of the brain, from which the cranial nerves come off. I, Olfactory nerves. II, Optic nerves, one half of each crosses to the opposite side of the brain. III, Oculomotor; IV, Trochlear, and VI, Abducent nerves; these are the three pairs of nerves which control the movements of the eyeball. V, Trigeminal nerve, the nerve of sensation in the face and teeth; it is the most frequent seat of neuralgia. VII, Facial nerve, which controls the muscles of the face (about the mouth, nose and ear), ear and scalp. VIII, Auditory nerve, or nerve of hearing. IX, Glosso-pharyngeal nerve, to the pharynx and back part of tongue; is one of the nerves of taste. X, Vagus, or pneumo-gastric nerve, to the lungs, heart, gullet, stomach and liver. XI, Spinal accessory nerve, to the trapezius muscle on the back of the neck and thorax. XII, Hypo-glossal nerve, which controls the muscles within the tongue, altering its shape. 1, 2 and 3, The first three spinal nerves.

Cerebellum, or small brain; **Pons,** or bridge, and **Medulla Oblongata,** or **Bulb,** which is the connecting link between the brain and spinal cord.

The **Cerebrum** occupies the fore and upper parts of the skull; it is divided by a deep longitudinal furrow into two halves—the **Cerebral Hemispheres.** Each hemisphere is thrown into folds, the **Convolutions;** this gives the cerebrum somewhat the appearance of a large, shelled walnut. If we cut into the hemispheres, we find them to be composed of a layer of gray matter (cells) on the outside, covering the white matter (fibers) within.

This gray matter is known as the **Cortex** (bark). It has been found that the cells in certain parts of the cortex are associated with movements of certain parts of the body, and that disease of these parts of the cortex causes loss of voluntary power in the parts of the body to which they correspond. These portions of the cortex are known as the cortical **Motor Centers;** they are grouped about a fissure or deep furrow at the side of each hemisphere. It has also been found that certain other parts of the cortex correspond to the different sense organs. Thus, one part of the cortex is connected with **seeing,** another with **hearing,** another with **taste,** and disease of these parts may produce blindness or deafness. These are the **Sensory Centers.**

The **Cerebellum** is much smaller than the cerebrum, and occupies the back and lower part of the skull. It is chiefly concerned in keep-

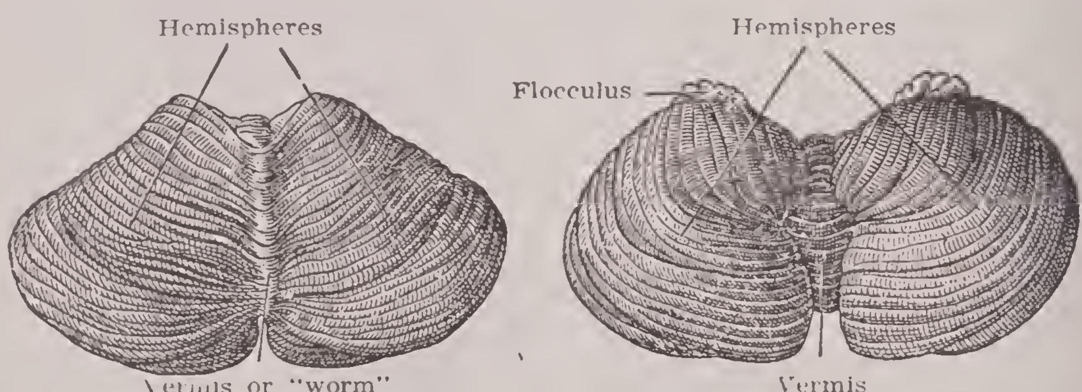


Fig. 43. The cerebellum or small brain, as seen from above (first figure) and from below (second figure).

ing up the balance of the body and controlling the voluntary muscles or coördinating their action, **i. e.,** bringing them into concerted and harmonious action. The exact and whole function of the cerebellum is not known. The cerebellum consists of gray and white matter, and is connected by tracts of nerve fibers with the cerebrum above and the cord below.

The **Pons**, or mid-brain, is a connecting link between the two cerebral hemispheres above and the bulb below, as well as between these and the cerebellum; and the two sides of the latter are con-

Fig. 44. The spinal cord, seen from behind. The upper part is shown cut off from the brain. The roots of the spinal nerves are shown along each side of the cord. The membrane covering the spinal cord is split up and laid open to show the cord and nerve roots within.

a. The medulla oblongata.
b. The lower end of the spinal cord.
c. The cervical or neck part of the cord.
d. The thoracic part of the cord.
e. The lumbar part of the cord.
f. The sacral nerves.
g. The coccygeal or last spinal nerves.

nected by it. It contains masses of gray matter, from which some important nerves originate.

The **Bulb**, or medulla oblongata, is a small expansion between the

pons and the cord; it lies in the lowest part of the cavity of the skull, and is continued down the neural canal as the spinal cord. It contains masses of gray matter, from which nerves arise; among others, those which pass down to supply the heart and lungs. The bulb thus may be said to contain the centers for the vital processes of circulation and respiration; injury to the bulb has often produced sudden death by stoppage of one or both of these vital processes.

The **Spinal Cord** occupies the neural canal, and is bounded in front by the column of vertebral bodies, being covered in at the sides and back by the neural arches. It is about 18 inches long, and is divided by a deep fissure in front and a partition or septum behind into two halves.

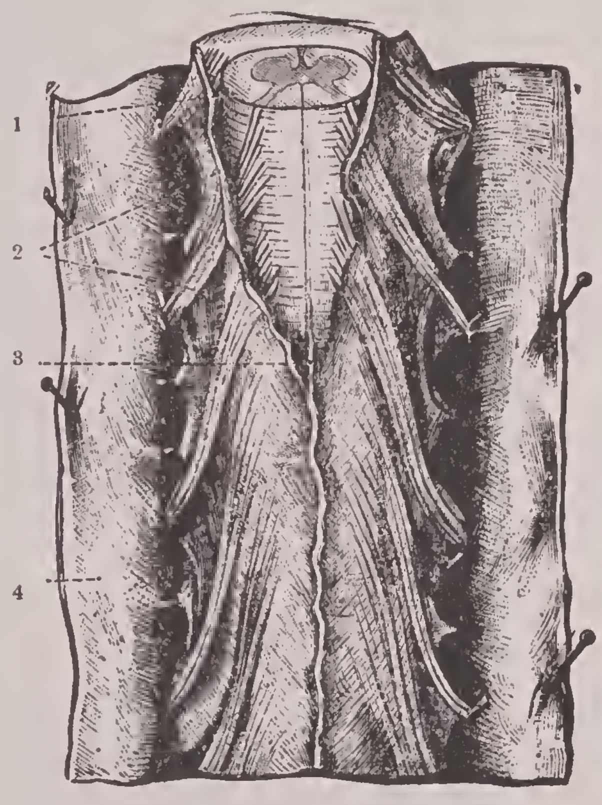


Fig. 45. The membranes of the spinal cord, seen from behind. 1, The pia mater, the thin, innermost covering in which lie the blood vessels of the cord. 2, The arachnoid membrane, partly opened up. 3, Its septum or partition. 4, The dura mater, the strong outermost covering of the cord, split open and pinned back. These three covering membranes are continued from the cord up over the brain. "Meningitis" is inflammation of these membranes or "meninges."

The **Gray Matter** (cells) of the cord is situated **in the interior,** not on the outside, as in the brain; and it is surrounded by **White Matter.** If the cord is cut across, it is seen to be rounded in section, and the gray matter is arranged in the form of two crescents placed back to back and imbedded in the white matter. From cells in the horns of these crescents, nerve fibers pass out of the cord to form the anterior or ventral roots of the **Spinal Nerves.** Each spinal nerve has two **roots—anterior** and **posterior**—coming from the anterior and posterior horns, respectively, of the gray crescent in the cord. The anterior root contains the **motor,** and the posterior root the **sensory,** fibers. On

the posterior root is a small swelling, the **ganglion** of the posterior root, containing cells which give rise to, and preside over the nutrition of, the fibers in the posterior root. The two roots join to form a **mixed motor and sensory nerve,** which, passing out from the neural canal, enters the tissues beyond. A pair of spinal nerves corresponds to each vertebra, one nerve going to each side. The spinal nerves are

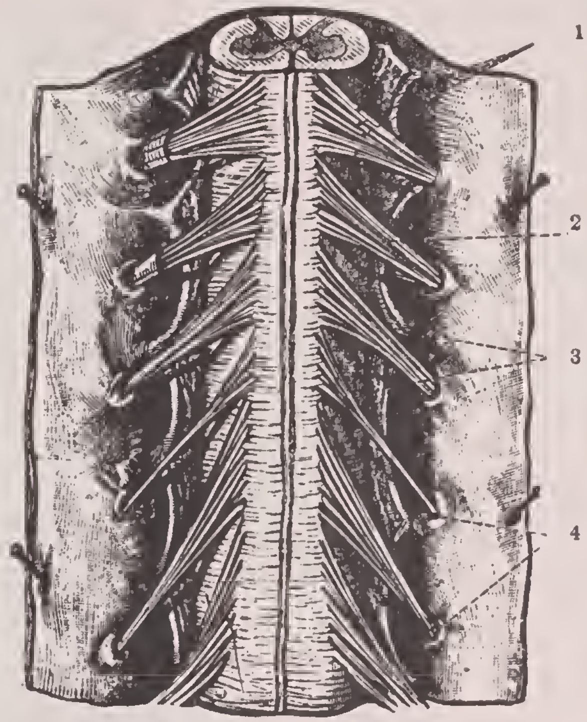


Fig. 46. A piece of the spinal cord seen from in front. The dura mater has been opened up and pinned back, and the arachnoid removed to show, 1, the nerve roots and, 3, the dentate ligaments, attached to the side of the cord and to the dura mater. 2 is the anterior roots of a nerve; pierces the dura mater at 4.

named by number and by the region of the spinal column from which they emerge, e. g., 3rd cervical, 6th thoracic, etc.

A **Nerve** consists of bundles of fibers wrapped together by fibrous tissue into a rounded cord. Each fiber consists of the following parts:

1. A central threadlike structure, the **Axis Cylinder,** which is the essential part of the fiber, and is a prolongation from a cell in some part of the brain or spinal cord or sense organ. The nerve fiber depends for its life upon the connection between the cell and the axis cylinder, and if this connection is broken the fiber degenerates and dies. **Regeneration** of the fiber may occur, however, and thus the paralysis which follows a nerve injury may disappear in time.

2. A **Sheath.** Nerve fibers are classed according to the kind of sheath they possess.

(a) Medullated nerve fibers are white and thick, being surrounded by a fatty covering inside their delicate sheath.

(b) Non-medullated fibers do not possess this fatty covering; they

are finer than medullated fibers, and lack their white and glistening appearance.

A mixed nerve, such as a spinal nerve, contains some of both kinds of fibers. Medullated fibers may be motor or sensory; non-medullated fibers are destined principally for the supply of the involuntary muscle of bloodvessels, and for internal organs.

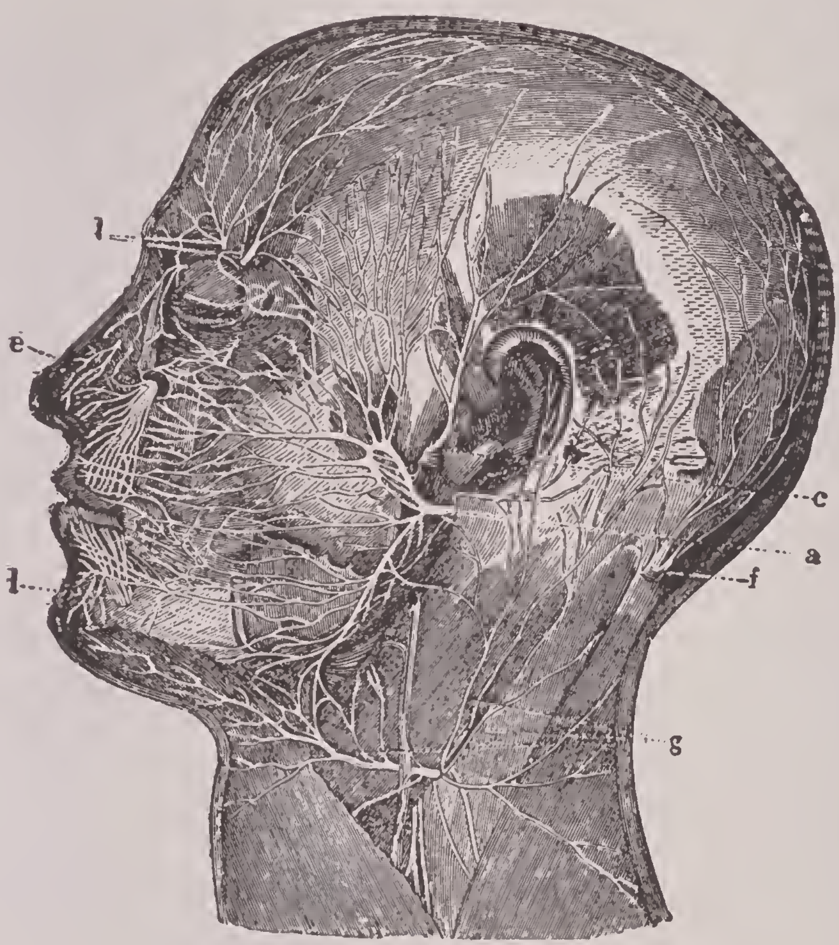


Fig. 47. The nerves of the face. a, Facial nerve; it controls the muscles that move the skin of the head (face and scalp). b, Nerves of sensation of the forehead and top of the head. c, Auriculo-temporal nerve. d, Mental or chin nerve. e, Infraorbital nerve for sensation in the cheek below the eye. f, Occipital nerve (sensory for back part of scalp). g, Great auricular, lesser occipital nerves (for ear and scalp) and nerves of the skin of the neck.

Twelve pairs of nerves are given off from the brain itself, and are known as the **Cranial Nerves.** They leave the skull by various apertures in the bones, and are of the same structure as the spinal nerves. The organs of sight, hearing, taste, and smell are connected by means of certain cranial nerves with the brain. Other cranial nerves supply the skin, teeth and other parts of the head and neck with sensation; others again go to the muscles of the face, jaws, tongue, etc.

The Sympathetic System is really formed by offshoots from the spinal nerves. It is a chain of **ganglia,** connected by nerve cords,

lying, something like a knotted string, on each side of the vertebral column.

Each ganglion consists of a mass of cells. It communicates with the neighboring spinal nerve by a branch consisting of non-medullated fibers. From the sympathetic ganglia are given off numerous nerves of the non-medullated class, which pass to the internal organs and bloodvessels. The sympathetic system is known as the **vegetative** nervous system, because it controls digestion, etc.; while the central nervous system is termed the **animal** nervous system, because it controls the functions of movement, feeling, etc., which characterize animals more than plants.

Termination of Nerve Fibers.—The **Motor Fibers** of a nerve end in muscles. Each muscle fiber has a very fine nerve fiber passing to it, and ending upon it by expanding into a sort of plate, which is closely applied to the surface of the muscle fiber. This is known as an **End Plate.** Through the end plate the nervous impulse passes to the muscle fiber, causing a contraction.

Fig. 48. A nerve ending for the sensation of touch. Much magnified.

Sensory Fibers end, or rather begin, in different ways, according to the sensation which they convey. These will be considered with the sense organs.

The Course of a Nervous Impulse.—In order to understand the connections between different parts of the nervous system, let us follow the course of events occurring whenever a voluntary action is performed. Let us take, for example, the act of saluting a friend in the street. Rays of light pass from every visible part of the friend into our eyes, and fall upon the back of the eyeballs. Here they set up chemical changes which produce an effect upon the sensory nerve

apparatus in this part. By this means sensory impulses are started, travel along the optic nerves to the back part of the brain, and arouse there, in the cortical cells where the path of the impulses ends, a set of changes, whereby we become conscious that we see our friend before us, and wish to salute him. This part of the process is the **Stimulus,** or **Excitation.**

The instant that a desire arises to show our friend that we recognize him, an impulse passes along from the **center for seeing,** which has just been excited, through fibers in the white matter of the brain, to the cells in the **motor centers** of the cortex, which, as we saw, were grouped around a fissure on each side of the cerebrum. Changes are set up in these cells, which give rise to a **Motor Impulse,** or message to the muscles. This impulse or message passes from the cortex, through the white matter of the hemisphere and pons, into the bulb. Here the nerve fibers conveying the motor impulses cross over to the other side, and pass down in the white matter of the cord, to end in, or near, cells in the anterior horns of the gray crescents. (Thus we see that the right half of the brain has to do with movements of the left half of the body, and **vice versâ,** the motor paths crossing one another in the bulb.) These fibers, having conveyed the message as far as the nerve cells in the gray matter of the cord, end; but the message is passed on by the cells to fresh fibers, passing out from the cord by the anterior nerve roots. Thus the message is conveyed direct to the muscles, where it produces in them **Contractions.** The arm muscles produce by their contractions the movements of raising the hat, stretching out the hand, etc.; the contractions of the muscles of the larynx, mouth, lips, and tongue give rise to speech, and so forth.

Every voluntary action is complex like this, but the nervous impulse travels with such lightning rapidity that we are not aware of the process as it takes place.

The Sense Organs.

1. **Touch.**—In the skin are numerous minute projections, called **Papillæ,** which contain rounded masses, known as **Tactile Corpuscles.** In these the finest nerve fibers are found, which convey impressions from the skin to the central nervous system. The tactile corpuscles are most numerous in the tips of the fingers and tongue, and are least numerous in the skin of the back.

2. **Taste.**—This special sense is located in the tongue and palate.

The tongue bears on its surface papillæ, or elevations, of three kinds:

(a) The **Circumvallate** papillæ, situated at the back of the tongue, are easily seen as rounded elevations, surrounded by a groove and ridge.

(b) The **Conical** papillæ cover most of the surface.

(c) The **Fungiform** papillæ are scattered here and there over the surface. In certain diseases, notably in scarlet fever, these show up bright red on a white furred tongue, and give the appearance known as "strawberry tongue."

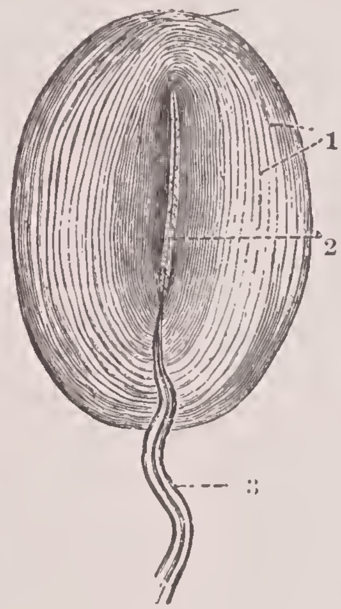


Fig. 49. A Pacinian nerve corpuscle—a small nervous organ in the skin for the sensation of touch. Much magnified. 1, The capsule consisting of many layers. 2, The nerve filament. 3, The nerve fibre entering the corpuscle.

In the walls of the fungiform and circumvallate papillæ, and in the membrane covering the soft palate, are found groups of cells known as **Taste buds**. Each taste bud contains elongated cells. One end of the cell, drawn out to a fine point, projects on the surface of the papillæ; the other end is connected with a nerve fiber. Fibers from many taste buds unite and form a part of the glossopharyngeal nerve, which is one of the cranial nerves.

Tasty substances are dissolved in the mouth by the saliva, and come into contact with the cells of the taste-buds; impressions of taste are conveyed to the brain by the **glossopharyngeal** nerve, also by the **lingual** nerve.

3. **Smell.**—The inside of the nose is lined with a mucous membrane, which contains in its upper part numbers of long tapering cells, spindle-shaped, with their free ends projecting above the level of the mucous membrane. The deep ends of these cells are connected with a network of fine nerve fibers, which unite together to form the **Olfactory Nerves** and convey impressions of smell to the brain.

4. **Hearing.**—The **Ear** consists of three parts: **External, Middle,** and **Internal.** (See figures in Hygiene of the Ear.)

The **External Ear,** or **Pinna,** consists of cartilage covered by skin. It is attached to the side of the head and collects the sound and conveys it to the inner parts of the ear, but is not necessary for hearing. Leading inwards from the external ear is a passage, the **External Auditory Canal,** or **Ear-Passage,** composed partly of cartilage and partly of bone. The whole canal measures about 1¼ inches in length in the adult, but much less in young children. Rather less than half of it is formed by a prolongation inwards of the cartilaginous pinna. The canal then enters the bone. It is closed at its inner end by the **Tympanic Membrane,** or **Drum-Membrane,** a thin translucent structure, dividing the external from the middle ear.

The **Middle Ear,** or **Tympanum** (or drum), is a small irregular cavity in the bone. At the bottom of it is an opening which leads into the **Eustachian Tube**; this opens into the back of the throat, and thus the tympanum communicates with the throat and so with the outer air. If you shut your mouth and hold your nose closed you can force air into the middle ear. Then on swallowing you can hear the air escape until the pressure is equal on both sides of the drumhead. The lining membrane of the throat passes up the Eustachian tube and lines the walls of the tympanum. Inflammation of the throat may extend into the middle ear, causing deafness, earache and in some cases an abscess or gathering.

Across the cavity of the tympanum there stretches a chain of three tiny bones: the **Malleus** (hammer), fixed to the tympanic membrane; the **Stapes** (stirrup), whose base closes an opening, the **Fenestra Ovalis,** in the upper part of the tympanum; and the **Incus** (anvil), lying between the two others and forming joints with them. The tympanum is supplied with numerous nerves and blood-vessels.

The **Internal Ear,** or **Labyrinth,** is the essential part of the organ of hearing, and consists of a membraneous tube contained within a bony tube hollowed out in the skull. It is called the labyrinth because it is twisted and coiled in a very complicated manner; it is lined with cells, and filled with a fluid called **Endolymph.**

The internal ear comes into relation with the middle ear in two places, (1) the **Fenestra Ovalis,** which is an opening in the bony wall of the tympanum, closed by membrane and by the base of the stirrup-bone, and (2) the **Fenestra Rotunda,** a similar opening lying below the fenestra ovalis, and also closed by a membrane. The endolymph

or fluid contents of the internal ear is kept from flowing into the middle ear by means of these closing membranes.

The internal ear consists of the **Vestibule,** into which open the **Cochlea** and the **Semicircular Canals.**

The **Semicircular Canals** are three in number, and are arranged at right angles to one another, in the three dimensions of space. They enable us to recognize movement and our position or attitude in space, e. g., as erect or inclined. The eyes of course also help, but they may be closed and still we know our position.

The **Cochlea** is a tube coiled spirally, like a snail-shell. A flat membrane stretches from one side of this tube partly across it, and takes the spiral form of the tube. This **Basilar Membrane** bears upon it the **Organ of Corti,** in which are found numerous elongated cells. The ends of the cells which project into the cavity of the cochlea are furnished with stiff hair-like projections, and are called **Hair Cells.** The other ends of these cells, applied to the basilar membrane, are connected with nerve fibers which unite to form a nerve passing down the central part of the cochlea, and joining the **Auditory Nerve,** which enters the brain.

How Sounds are Heard.—A sound is the result of vibrations in the air. When one body strikes another so as to produce a sound, waves are set up in the air and reach the external ear, pass down the external auditory meatus, and strike against the tympanic membrane. This is set into vibration; the motion is conducted along the chain of bones, and is communicated through the fenestra ovalis to the endolymph in the internal ear. The endolymph is set into vibration, and its movements within the cochlea cause alterations in the tension of the basilar membrane and changes in the hair cells. These changes create nervous impulses in the nerves connected with the hair cells, which are conveyed to the brain by the auditory nerve as impressions of sound.

Different parts of the basilar membrane and of the organ of Corti respond to vibrations caused by different tones; there is a special part for every tone which the ear is capable of appreciating; and the movements of the endolymph set vibrating that particular part of the membrane that corresponds to the tone which is being produced at the time.

5. **Sight.**—The **Eye** is lodged in a bony cavity, the **Orbit,** which protects and covers it in except in front. Here it is covered by the **Eyelids,** fringed with hairs, the **Eyelashes.**

The **Eyelids** are lined with a sensitive mucous membrane, the

Conjunctiva, which passes from them on to the front of the eyeball, which it covers over. The **Cornea** is a clear, transparent part of the conjunctiva. The conjunctiva lining the eyelids is the **palpebral,** while that covering the eyeball is the **orbital conjunctiva.**

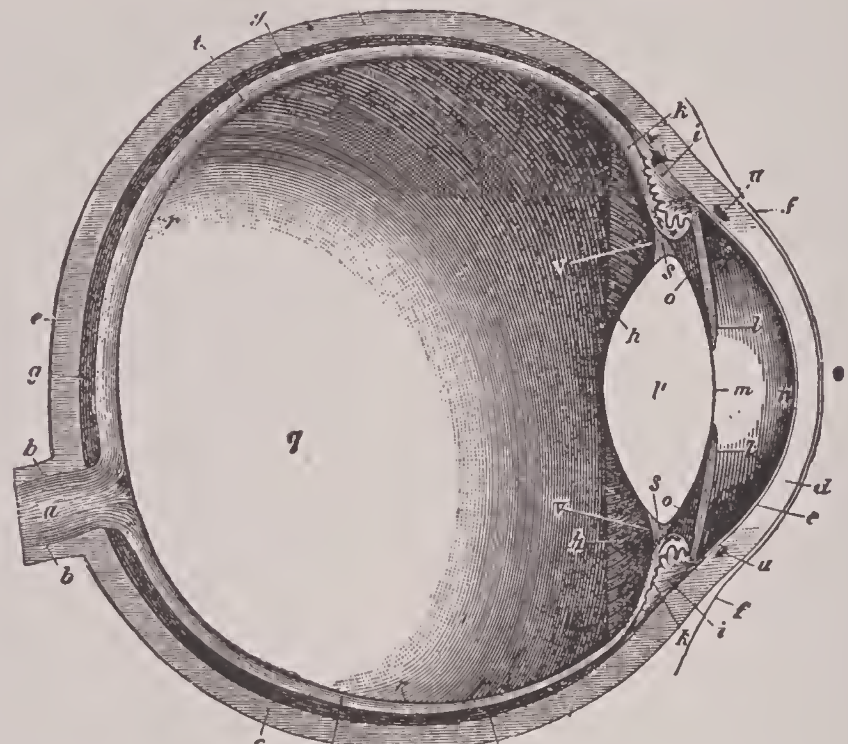


Fig. 50. The lower half of the left eye seen from above.

a, Optic nerve. b b, Its sheath. c, Sclerotic or fibrous, protecting coat of the eyeball. d, Cornea, horn-like transparent front of the eyeball. e. Lining of anterior chamber. f, Conjunctiva or covering of the free surface. g, Choroid or vascular coat (with many blood-vessels). h, Ciliary ring. i i, Ciliary bodies. k k, Processes or projections of the ciliary ring. l l, Iris or rainbow colored curtain or diaphragm by which the amount of light entering the eye is regulated, because it controls the size of m, the pupil or central hole in the iris. n, Anterior, and o, posterior chamber of the eye. p, Lens and its capsule. q, Vitreous or glassy body. r, Boundary of the retina, t. s, Petit's canal, a circular space about the edge of the lens. t, Retina, the seeing or sensory coat of the eye. u, Schlemm's canal, a fine canal around the edge of the cornea. v, Suspensory ligament, attaching the ciliary processes to the capsule of the lens, holding the latter in place and allowing the ciliary muscle in the ciliary body to influence the shape of the lens.

The **Lachrymal Gland,** which secretes moisture (tears), to keep the surface of the eyeball from getting dry, and to wash away dust and foreign particles, lies to the upper and outer part of the orbit. At the inner end of each eyelid is a small opening, the punctum lachrymale, leading into canals, the **lachrymal canals,** which join together to form the **Lachrymal Duct.** This passes downward and opens into the nasal cavity and drains off the moisture from the eye. Thus, when the tears are excited to flow as by the wind, by an onion, or by an emotion, the nose "runs" because the tears are conveyed into it. If the tears be secreted faster than they can drain into the nose they then flow down the cheek.

The **Eyeball** consists of three coats: an outer tough, fibrous layer,

the **Sclerotic**; a middle vascular layer, the **Choroid**; and an inner layer, the **Retina,** which contains the beginnings of the **Optic Nerve.** At the front of the eyeball, the choroid is continued forward in the form of a colored curtain, the **Iris,** in the center of which is the **Pupil of the Eye,** a rounded hole, through which rays of light pass to reach the retina at the back of the eyeball.

The size of the pupil is regulated by muscular fibers in the iris, which by their contraction and relaxation make the pupil smaller or larger.

In front of the iris, the sclerotic continues forward as a transparent, window-like structure, the **Cornea.**

Between the cornea and the iris is the **Anterior Chamber of the Eye.** The lens is called the **Posterior Chamber.** The space between the iris and behind the iris is a transparent body, called the **Crystalline Lens,** which serves to bring the rays of light to a focus upon the retina.

The rest of the inside of the eyeball, behind the lens, is occupied by a transparent, jelly-like fluid, the **Vitreous Humour.**

The anterior and posterior chambers are filled with a clear, watery fluid, the **Aqueous Humour.**

A black or dark appearance is given to the inside of the eye, owing to the presence of a layer of cells containing **Pigment,** or coloring matter, lying between the choroid and the retina. This absorbs the light and so prevents confusion, because the retina is then acted on only by light which comes directly to it through the pupil and the lens.

The **Retina** is the most important of the coats of the eyeball, for in it expand the fibers of the optic nerve, through which impressions of sight are conveyed to the brain. The retina is composed of different layers of cells. The outermost layer, lying next to the choroid, and separated from it by the layer of pigment cells and a fine membrane, is called the **Layer of Rods and Cones.** These are cells shaped as their names indicate, some elongated and others conical in form, packed side by side. From their ends pass fine fibers, which expand into granular rounded bodies, forming the **Outer Nuclear Layer.** Fibers from these form a branching network. Next comes another layer of granular bodies, the **Inner Nuclear Layer,** which in their turn give off fibers interlacing with each other and forming a network. Close to the inner surface of the retina, next to the vitreous humour, is a layer of large **Nerve Cells,** which send processes into the network of the inner nuclear layer, and which are connected by fine

nerve fibers with the **Optic Nerve.** This leaves the eyeball at about the middle of the retina, passes backwards through the orbit, and reaches the brain. The part of the retina where the nerve fibers collect to form the optic nerve is blind, and is known as the **blind spot.** It may be seen thus: close one eye (say the left); hold the thumb in front of you a foot or so from the eye; look steadily at the left thumb nail and move the right thumb away to the right; at a certain point (about four or five inches from the left thumb when about a foot from the eye) the right thumb nail is lost sight of, but further on it again becomes visible. Ordinarily the blind spot is not known of and is not taken cognizance of.

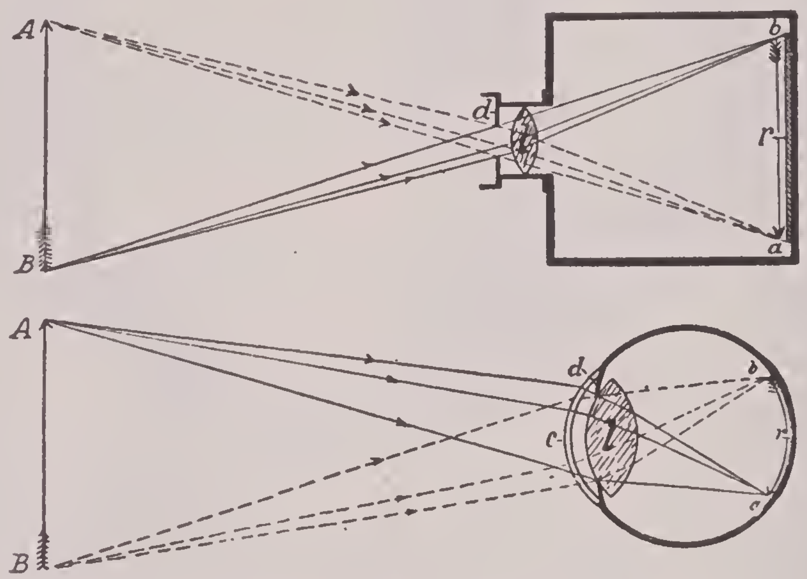


Fig. 51. Diagram of the eye-ball.

The eyeball compared with a photographer's camera. A B represents an object of which an image, a b, is formed on the back of the camera, or retina. r; d is the diaphragm (or iris in the eye), which adjusts the amount of light entering; l is the lens; c is the cornea. Note that the image is inverted, and that its size is smaller the more distant the object.

When we look at an object its image is formed on the part of the retina that is most sensitive, the **macula lutea,** or **yellow spot;** its center is depressed to form the **fovea centralis,** and it is here that the vision is most acute. We can see objects not looked directly at, but do not see them clearly.

Vision.—Rays of light pass from an object through the pupil into the eye. The crystalline lens brings these rays to a focus upon the retina. Changes are set up in the rods and cones, producing impulses which pass through all the layers of the retina until they reach the large nerve cells. Here the impulses are passed on into the small fibers of the optic nerve, and so are conveyed to the brain, where they become sensations of sight.

PART TWO—*Hygiene*

The Art of Preserving and Restoring Health without Recourse to Medicine

How to Maintain Vigorous Health, Avoiding Violation of the Laws of Nature.

Subject Reference

For Life-Giving, Body-Building Foods, see pages 318-403, also see How to Avoid Disease, Vol. 2, pages 471-530.

**"Health is Man's Birthright—
It is as Natural to be Well as to be Born."**

INSTRUCTION SIX—*Ignorance Cause of All Disease*

The great philosopher, Herbert Spencer, proved that knowledge may have **intrinsic** value, and that some knowledge must be of greater value than other. In our brief lives it is necessary to give preference to the useful, real, and effective as distinguished from the non-useful, conventional, and ornamental. In the words of a Baconian phrase, "we must determine the **relative** value of knowledges." In the order of their importance, the chief kinds of activity which occur in human life are:

1. Those activities which relate **directly to self-preservation.**
2. Those activities which, by securing the necessaries of life, are **indirectly related to self-preservation.**
3. Those activities which concern the rearing and disciplining of **offspring.**
4. Those activities which have to do with the maintenance of proper **social** and **political** relations.
5. Those miscellaneous activities of the **leisure** part of life, which are devoted to the gratification of the taste and feelings.

The order of value then is: Education which prepares directly for self-preservation; that which prepares indirectly for self-preservation;

that which prepares for parenthood; that which prepares for citizenship, and that which prepares for miscellaneous refinements.

Spencer states with great emphasis that those actions and precautions which continually secure self-preservation are of primary importance; and that, "as **vigorous health** and its accompanying **high spirits** are **larger elements of happiness than any other things whatsoever,** the teaching how to maintain them is a teaching that should yield in moment to no other whatever."

Fortunately, knowledge necessary to direct self-preservation is largely provided for by nature. The common **animal instincts** give warning against dangers that are imminent in the material world. The inquisitive and restless infant is chiefly concerned acquiring the powers of coördination, estimation of distance, size, consistence, and weight, and learning to avoid things likely to cause pain, etc. Throughout childhood and youth there is a further elaboration of these first requisites. More than this, however, is essential, for besides the dangers from mechanical causes, there are the equally real and great evils due to breaches of laws of physiology, and knowledge of these laws is gotten most largely by instruction. Innate ignorance of these laws of life is often so great that people do not even know that our sensations are our **natural** and most trustworthy guides. A proper and timely understanding of the ill effects of improper food and bad air, the abuse of stimulants and narcotics, the modern dissipations and vices, etc., can be made general only by careful and well regulated education.

"Health is man's birthright; it is as natural to be well as to be born." Ignorance and consequent violation of physiologic and hygienic laws are the sources of all disease and tendency to disease. Yet so lacking or insufficient has been instruction in the fundamental principles of applied physiology as a means to complete living, that a thoroughly well person above middle age is to-day the exception. On every side are chronic complaint, physical weakness, constant weariness, and unhappy gloom, which might have been prevented by the right instruction included in the education of the child.

Only too common an example of ill health, due to avoidable suffering, is that of the victim of worry. The mind and the body are so intimately related that continuous worry is certain to result in physical ills; and, on the other hand, one of the greatest safeguards to the maintenance of health, or aids to its recovery, is a cheerful and hopeful mind. Undue and misguided ambition, misdirection of energy, longing for the unattainable, regret for the unalterable, anticipation

and apprehension of future events, lack of a sense of perspective, undue regard for non-essentials, reopening of questions already settled, avarice, selfishness, excessive emotion of any kind, and the actual cultivation of the melancholic state, are some of the causes of physical ills that are not commonly recognized as coming under hygienic control, but which are most certainly avoidable by a right knowledge of hygiene. Those who are physically or mentally defective are made allowance for, but little sympathy or guidance is offered to the practically normal person who is gradually becoming the slave of a habit of worry, letting the lesser trials and troubles of a day shut out much of the sunshine and happiness of life. That worry is a spiritual evil and utterly futile should be made clear, and its certain consequence of lowered health or of positive disease is not as often insisted on as it should be.

Illness that is preventable causes not only mental and bodily suffering, but also wastes valuable time and ill-spared money, curtails useful commercial and professional abilities, renders good parenthood and good citizenship impossible, prevents amusement and happiness and markedly shortens life. "Is it not clear," says Herbert Spencer, "that the physical sins—partly our forefathers' and party our own—which produce this ill health deduct more from complete living than anything else, and to a greater extent make life a failure and a burden instead of a benefaction and a pleasure?"

Most cases of illness are preventable. Thomas Huxley says they should be looked upon as criminal. Illness due to disobedience of physiologic laws is the punishment of reprehensible conduct and not simply grievance. There is such a thing as physical morality and the preservation of health is a sacred duty. Persons who transgress rules of personal hygiene of which they should have a definite understanding are physical sinners, and are committing a crime not only against themselves, but also against those who are dependent on them or associated with them, as well as against future generations.

Public hygiene may be enforced. Personal and domestic hygiene must be left to the intelligence of the people, but should be clearly taught. The law can not compel citizens in times of typhoid fever or cholera to boil their drinking water or properly to cleanse food that is to be eaten without cooking. But strong and persistent warnings from the health authorities, public lectures, instruction from family physicians, newspaper and periodical discussion and even more effective than any of these, the general study of judiciously and carefully prepared books on hygiene, will be of greatest service in pre-

venting the spread of disease. General sanitary improvement depends on the intelligence of the community, as well as upon the efficiency of health officials, one of whose most important duties should be to strengthen public confidence in public, domestic, and personal hygiene and to disseminate more widely knowledge thereof.

It is not merely the teaching of the rules of hygiene that is needed, nor the ordinary course in school physiology. Personal hygiene is applied physiology, and a proper understanding of certain elemental truths of physiology is involved and must be had before the hygiene can be intelligently practiced. The normal functions of the body and the simple methods of keeping them in healthy action is the one thing of which every educated person should have a clear knowledge; yet most children grow up without sufficient parental or scholastic instruction in many matters essential to health. There are many men and women who would be greatly chagrined to mispronounce a popular foreign proper name, or who would resent any imputation of their lacking general culture or learning, yet they show not the slightest embarrassment over their ignorance of the processes of digestion, circulation, respiration, etc. Persons of intelligence often thoughtlessly furnish recommendations of purely "quack" remedies, unscientific instruments and useless apparatus; and advertisements not only of these articles, but also of others that are readily recognized as positively harmful or even vicious may be seen in the best general and religious periodicals.

In regard to the long-established classical instruction demanded by British parents for their sons at the university, Herbert Spencer says: "While anxious that their sons should be well up in the superstitions of two thousand years ago, they care not that they should be taught anything about the structures and functions of their own bodies—nay, would even disapprove such instruction. So overwhelming is the influence of established routine! So terribly in our education does the ornamental override the useful!" A similar arraignment is only too true of many American parents—especially as to the daughter's education. And on the daughter of to-day will depend the regimen of the nursery, the rearing and training of children, the preparation of food, and the problems of domestic hygiene of the next generation.

There is no other one thing that can advance the welfare of humanity more than a general understanding and practice of the laws of health. A prominent journal (World's Work) says: "If all easily preventable physical troubles were prevented, such an addition would

be made to the energy and the good sense of the people as defies description. A merely incidental item of such social progress would be the incalculable saving of the money spent on quackery, and of the waste of energy that quackery causes."

INSTRUCTION SEVEN—*Care of the Skin*

Health and Beauty

The Bath, Toilet, Complexion

How to Keep the Skin Perfectly Healthy.

Care of the Complexion: Cold Creams, Toilet Lotions, Face Powders, Wearing Apparel, Care of the Feet, Care of the Hair, Care of the Finger-Nails.

Bathing: Cold Bath, Warm Bath, Tepid Bath, Sea Bathing, Turkish or Hot Air Bath, Russian Bath.

Subject Reference.

For Skin Diseases, see Vol. 2, pages 457-466.

For how to give Massage and Baths, see Vol. 2, pages 639-647.

The Skin, Its Structure and Functions.

The skin consists of a thin superficial layer, the **epidermis, cuticle,** or **scarf skin,** and a deep layer, the **derma, cutis** or **true skin.**

The **epidermis** is easily separated from the true skin. It is the part raised by a blister. The superficial cells are dry and flat and form the horny layer of the epidermis. This layer is very thick on the soles (especially the heel) and palms, and is much thickened in callosities and corns. The deeper cells are moist and are polygonal in shape. They form the mucous or malpighian layer. The cells of the deepest layer multiply by dividing into two and the new cells push the older ones towards the surface, from which they are continually being loosened and shed. This process of shedding is aided by the friction of the clothing, by bathing and especially by brisk rubbing with a towel.

Only upon the scalp do the minute scales tend to become visible to the eye and appear as flakes, forming a condition commonly known as "dandruff." This natural shedding of the epidermis when not in excess should be aided by bathing the skin and shampooing and brushing the scalp.

The epidermis is very insensitive and has no blood vessels in it.

It is nourished by fluid which soaks into the deepest cells from the true skin.

In the deep portion of the mucous layer of the epidermis is situated the **pigment**, which gives the color to the skin. There is an old adage that "beauty is only skin deep," but in fact color is only one-half skin deep. The various colors of the skin of the different races of man are due to the varying amounts of pigment in the deep layer of

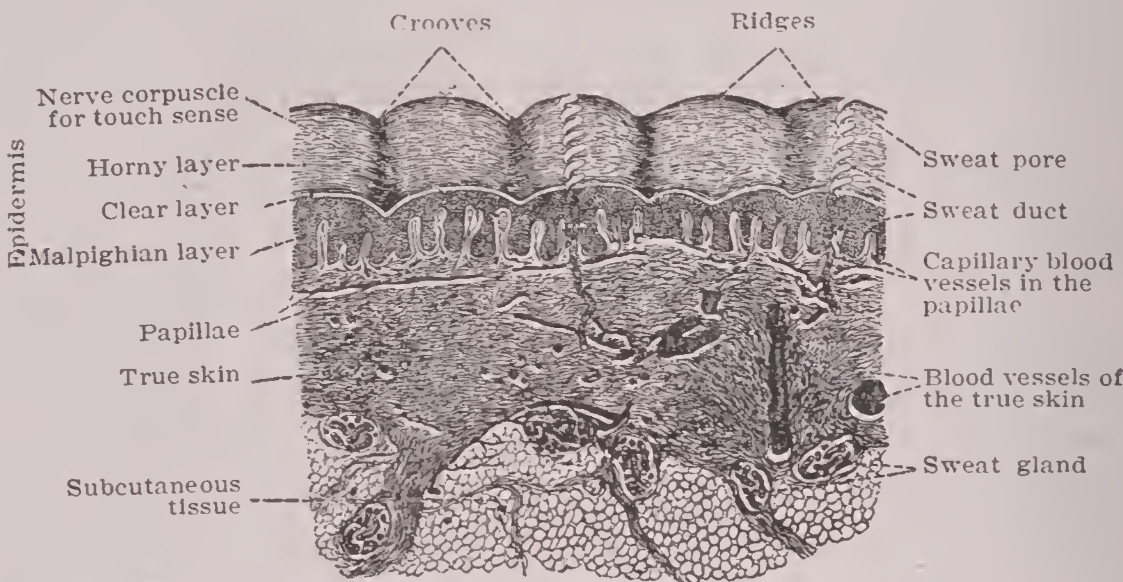


Fig. 52. The skin of the finger-tip to show the layers of the skin.

the epidermis. Under the influence of the sun's rays the pigment is most readily produced. Not only are races living in the tropics therefore as a rule much darker than the inhabitants of a cold climate, but in the temperate climate an increased production of pigment occurs in summer in the form of tan and freckles. Occasionally the function of pigment formation ceases, and the diseases known as "vitiligo" and "albinism" result. **Vitiligo** is characterized by white spots, most frequently on the backs of the hands, while **albinism** consists of a total absence of pigment in the skin, hair, and eyes. The opposite condition, however, is more common, namely, the production of too much pigment, as seen in the formation of **freckles** and the so-called "liver spots" or "moth patches."

The epidermis protects the underlying true skin from injury and from drying, and keeps it soft and pliable. The hair and nails are formed from the epidermis.

The True Skin.—The upper surface of the derma or true skin has many little finger-like projections, the **papillæ**. The epidermis fills in all around and between these. On the palms and soles the papillæ are large and are arranged in rows so that the surface of the skin is

ridged. These ridges form patterns which are different for every individual but are permanent for life. They thus serve as means of identification and are utilized in the Bertillon system of identifying criminals. The true skin is the organ of sensation, and the nerve-endings giving rise to sensations of touch, pain, and temperature are

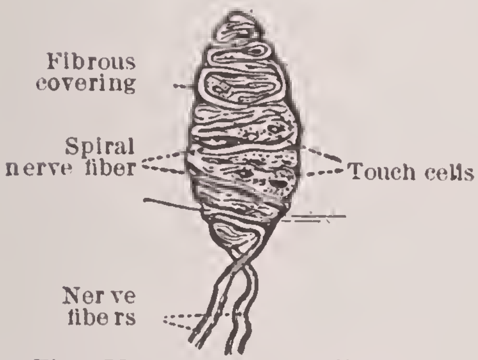


Fig. 53. A nerve ending or touch corpuscle in the skin of the finger

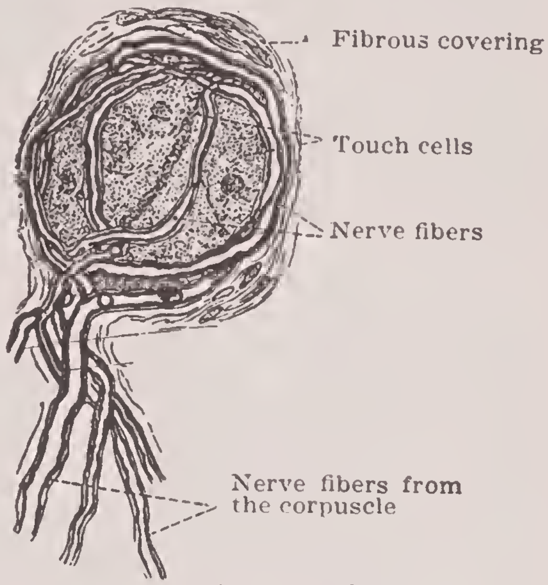


Fig. 54. A touch corpuscle magnified 310 times. From the conjunctiva of the eye.

contained in the little hillocks or papillæ. The deeper parts of the skin, together with the underlying fat, serve as a protection to the body against violence and against extremes of heat or cold.

The glands in the skin are of two kinds—the sweat or perspiratory and the sebaceous or oil-producing.

The sweat glands consist of little tubes ending in coils lying deep in the true skin or in the fat beneath. An outlet or duct runs in a spiral course to the free surface of the skin. The duct openings, or "pores," as they are popularly termed, are found everywhere on the surface of the body and are present in very great numbers. It has been calculated that the entire number of glands, if placed end to end, would cover a distance of twenty-eight miles. Next to the kidneys the sweat glands are the chief means of removing water from the system, and in addition they carry away various other waste products. The skin, by means of the sweat glands, performs the important function of **regulation of the body temperature**. When the body is at rest or only slightly in action the perspiration is small in amount and is constantly removed in the form of a vapor; it is then spoken of as "insensible," because none can be seen on the skin. When, however, considerable exercise is taken the pores become more

active and produce a larger amount of perspiration, which is termed sensible, because it does not evaporate as fast as it is poured out, but gathers on the surface in small drops. In evaporating the sweat takes up a great deal of heat from the body. Hence the temperature can be lowered by much perspiration, and rises when this ceases. The condition of the atmosphere greatly influences the amount of perspiration. If the air is saturated with moisture, the perspiration does not readily evaporate, but remains upon the body. If the air is dry, and especially if it is in motion, the perspiration readily evaporates and the body is cooled. It is in this way that fanning cools the skin. Wiping away the perspiration with a handkerchief does not cool one.

When the surrounding air is much warmer than the body or when the body is very active and much heat is generated, the vessels of the skin dilate, free perspiration takes place, and by its evaporation the body becomes cooled. If the air is already full of moisture, evaporation of the perspiration becomes very difficult, and we suffer more from heat than if the air were dry. This phenomenon of finding hot weather most uncomfortable when moisture is present in the air is known to all through disagreeable experience. It is for the same reason that a much higher temperature can be borne in the Turkish bath where the air is dry than in the hot vapor or Russian bath.

When the air is cooler than the body the blood vessels contract and the warmth of the body is retained by lessening the amount of blood in the skin to be cooled. The activity of the sweat glands is controlled by the nervous system. Thus emotion, as for instance fear, may cause a profuse sweat or again emotion may arrest perspiration as well as other sensations, notably the saliva, so that the mouth becomes dry. Considering the purposes of the sweat glands, it is highly important to remove the dry scales of the epidermis which continually accumulate and interfere with their free action. While this is done partially by the friction of the clothing, nothing takes the place of systematic bathing to keep the skin in a perfectly healthy condition.

The perspiratory glands give out moisture, but it is not probable that they absorb any appreciable amount of water from without. The same is true of salt in solution, and the efficacy of sea bathing in giving and maintaining health and vigor is due to causes other than the absorption of salt.

The oil-producing or sebaceous glands are found in nearly all parts of the skin, except the palms and soles. They are especially abundant on the face. They are small sack-like bodies, situated more super-

ficially than the sweat glands, and opening in most cases into the little pits, known as the hair follicles, for the hairs. They secrete a greasy substance, to lubricate the skin and keep it soft and pliable. The special oil glands of the eyelids, the Meibomian glands, prevent the lids adhering together by their edges, while those of the scalp supply a natural hair oil or pomatum. The oily secretion in general protects the body from moisture, as it does in the case of birds and hairy aquatic animals.

The hair and nails, though appearing to be entirely different in structure from the skin, are merely modifications of its horny layer or epidermis.

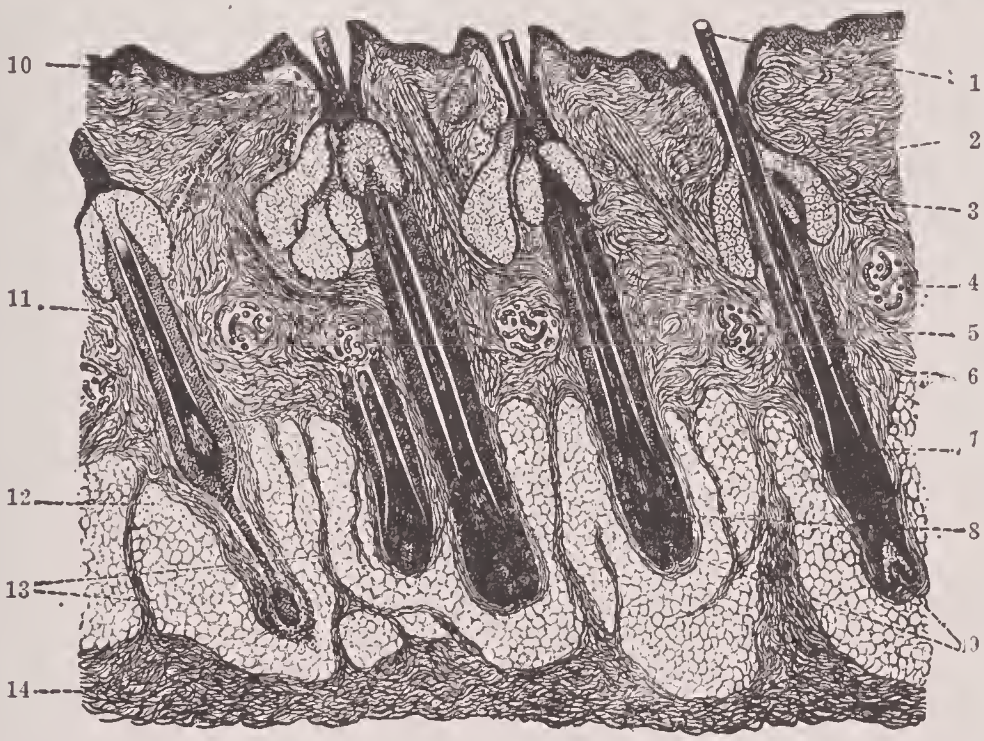


Fig. 55. The scalp. A section magnified eighteen times to show the roots of hair, sebaceous glands, sweat glands, etc. 1, Shaft of hair. 2, Muscle to erect hair. 3, Sebaceous or oil gland. 4, Sweat gland. 5, Hair follicle. 6, Root of hair. 7, Hair-bulb of hair which is being shed. 8, Hair-bulb. 9, Papilla of hair (a projection of the true skin into the hair-bulb). 10, Epidermis (scarf skin). 11, True skin. 12, Subcutaneous tissue (with much fat); the hair near this end is being shed. 13, Fibrous bands to attach the scalp to the fibrous layer, 14, deeper in.

A **hair** consists of a **shaft** which appears above the surface of the skin, and a **root** which is placed in a pocket of the skin, called the **hair follicle.** At the bottom of the follicle the hair and the various layers of the skin are continuous. The hair consists of three different layers, and has been compared, in structure, to the trunk of a tree. The main portion, the fibrous portion, is comparable to the dense wood of the tree, and consists of flat long cells. It constitutes the main bulk of the hair. The central portion, or pith, consists of nearly spherical

cells. The outermost layer of the hair consists of flat cells which overlap one another like tiles on a roof, and to this fact is due the rough feeling when a hair is pulled between the fingers from the point toward the root. The property of "felting" is also due to this peculiar saw-like surface of hair. Owing to this also a loose hair may at times work its way into a wound.

The color of hair depends upon the presence of pigment in the pith and in the fibrous layer, and upon the presence of minute bubbles of air. The greater part of the skin has fine, downy hairs, the **lanugo,** whose roots extend but a short distance into the skin, while the roots of the large stiff hairs extend into the fat beneath the skin.

The hair serves various useful purposes, besides being a very great adornment to the body. Thus it protects the head against the sun's rays and against violence, and affords a very considerable amount of warmth. The eyelashes protect the eyes against the entrance of foreign bodies, and the stiff hairs of the ear and nose prevent intrusion of insects and other foreign bodies. The moustache is supposed to act as a filter of the air that is breathed, while the beard protects the throat from cold. The hair also directs the course of water or sweat running on the body; thus the eyebrows direct the sweat to the side, away from the eye. The moustache may have a similar effect.

The nail consists of modified horny tissue lying upon the **nail bed,** which is a portion of the true skin. The nail itself corresponds to the epidermis in this region. The sides and root of the nail are embedded in folds of skin, while its end is free. Near the root of the nail is seen a semilunar area, which is more opaque than the rest of the nail, due to a scarcity of blood vessels in this situation.

The nail itself is colorless and bloodless. Its apparent color is due entirely to the blood vessels of the nail bed beneath, which shine through the translucent substance. The growth of the nail takes place at its root by constant formation of new cells pushing the nail forward. If, however, an obstacle to its forward growth is offered by a tight-fitting shoe sooner or later the nails will grow into the flesh, and the painful condition of "ingrowing nail" will result.

Food, occupation, exercise, bathing and clothing all have a very close relation to the health of the skin. The maintenance of the skin in a healthful condition depends largely upon a proper dietary, systematic exercise, regular bathing and proper clothing.

Bathing.

The superficial scales of the epidermis tend to collect, and with the sebum (or fatty secretion of the sebaceous glands) and dirt to

form a pellicle which interferes with the proper functions of the sweat glands. Bathing removes this layer of cast-off cells, sebum and dirt and is an important factor in maintaining the skin healthy. In addition it has a beneficial effect upon the general health, as the skin is intimately connected with the internal organs by the nervous system and also by its blood vessels.

Kinds of Baths.—Baths are local or general, according as they involve a portion or a whole of the body. Again, according to temperature, they are hot, over 98° F.; warm, between 90° and 98° F.; tepid, between 80° and 90° F.; cool, between 65° and 80° F.; and cold, below 65° F. These are merely arbitrary, but convenient distinctions. For practical purposes it will suffice to describe the cold, the warm, and the tepid bath.

The cold bath acts as a **stimulant** and gives strength, as opposed to the warm bath, which has a soothing action, or is **sedative**. The proper time to take a cold bath is before breakfast, as soon after rising as convenient. A simple and effective way of taking the morning bath is with the **sponge**, when the conveniences of a shower bath or tub are not always at hand. Every one can have a sponge and a bowl of cold water, and will find health and enjoyment in their daily use. Considering the fact that cold baths are so beneficial and pleasant, as those who take them regularly affirm, it is strange that in this country such a small number of persons indulge in them. Many say that they cannot take the cold bath, as it gives them too great a shock, or is too weakening, or is not followed by a proper reaction. On the contrary, however, most persons can take a cold bath every morning if they will only make up their minds to do so and will go about it properly. It would not, of course, be advisable for one advanced in years, when the blood vessels are naturally weak, to risk apoplexy by plunging into a cold bath without being properly trained to it by gradual stages.

The effect of the cold bath is to contract the blood vessels of the skin and to drive the blood to the internal organs, causing pallor of the skin. The breathing is greatly increased in depth, quickened at first and then slowed. The pulse is slowed and the temperature somewhat lowered. The nervous system and especially the mental faculties are immediately and very powerfully stimulated. Upon emerging from the bath, if the reaction takes place, the tiny arteries dilate and the skin becomes flushed, the pulse and respiration soon become normal, and the bather very quickly experiences a sensation of warmth and general wellbeing. This **reaction** is the test as to

whether or not the bath is well borne. With habitual bathers it will take place very speedily, and a delightful feeling of warmth will very soon be the reward of having for a moment braved the cold water. After leaving the bath, in order to aid the reaction the bather should rub the body from head to foot with a rough towel till the skin fairly glows; when the skin is entirely dry the clothing may be put on without delay.

Most persons are able to take cold baths, but they should become accustomed to them gradually. Not only do well persons maintain their health and strength, but many in poor health, and especially those of a nervous temperament, can derive much good from the daily cold bath. The best time to begin systematic cold bathing is in warmer months, and by the time winter arrives they can be kept up with very little trouble or discomfort. If one has not the conveniences of a tub, or fears such a decided innovation as a tub bath, it is well to begin with a cold **sponge bath.** The sponge should be saturated with cold water and squeezed or quickly passed over the arms, then over the chest and back, and finally over the legs, after which the whole body should have a vigorous rubbing. The water may be warmed somewhat at first, and gradually used colder as the bather becomes accustomed to the cold water. The temperature of the water should not be so extremely low, however, as to interfere with a thorough and speedy reaction. An excellent way of taking the morning cold bath is by means of **the shower,** which is stimulating through the impact of the water against the skin as well as through its temperature. Nothing quite equals the full tub bath, however, if the bather will begin with water only moderately cold, or will first become accustomed to the sponge bath, and then change to tub baths. One of the most beneficial results of cold baths is the almost universal freedom from catching cold, as every one who takes a cold bath daily well knows.

The Warm Bath.—The cold and the warm baths are almost directly opposite in their effect and purposes. The warm bath dilates the tiny arteries, as is shown by redness of the skin, and causes profuse perspiration. The pulse and respiration are increased in frequency and the temperature is raised. The warm bath has an extremely soothing effect on the nervous system, and for this reason is best taken at night before retiring. The perspiration which is likely to continue after a warm bath is disagreeable to some, and may be prevented by finally sponging the body with cold water at the end of the bath. After an unusual amount of physical labor, when

the muscles are sore and aching, nothing is more welcome or soothing than a warm bath. The blood is withdrawn from the muscles, and pain and soreness quickly disappear. In addition to removing muscular soreness and pain, the warm bath is relaxing and tends to relieve spasmodic conditions or cramps. For those who suffer from difficulty in getting to sleep, a warm bath just before retiring will often secure a refreshing slumber. The warm bath is to be highly recommended as a means of relieving weariness after prolonged physical exertion, but under no circumstances should a cold bath be taken at this time.

The hot bath (above 98° F.) should be taken only on the advice of a physician.

The tepid bath has not decided internal or mental effect and is generally employed for cleansing purposes. It may be taken any time during the day, though preferably in the afternoon or just before bedtime.

The proper time to bathe is just before a meal or about three hours after. In order to digest food properly the stomach needs an abundant supply of blood, and if the blood is diverted from the stomach to the surface of the body by means of a bath the digestion will necessarily suffer.

Soap.—As water alone does not dissolve the natural fat or oil on the skin, the use of soap is necessary to effect a thorough cleansing. Soap is a combination of a fat with an alkali (or lye) in greater or less excess. The latter combines with the fat of the skin, thus forming a soap, rendering it freely soluble in water. **Potash** is the alkali used to make **soft soap,** while **hard soap** is made by combining the fat with **soda.** A soap is said to be **neutral** when the alkali nearly equals or is in very slight excess of the fat. To this class belong most of our ordinary toilet soaps. A good soap should be made of pure fresh fat, should not contain too much alkali, which irritates and roughens the skin, and the amount of water should not be so great as to cause unnecessary waste by making the soap dissolve too easily and quickly. Adulteration with foreign substances, such as silica, which is added to increase the weight and bulk, should be avoided. The silica, however, acts in a measure mechanically, but is more adapted to kitchen purposes.

The harm done by impure soaps is very small in proportion to the fear expressed concerning their use. Any toilet soap on the market may be safely used by the majority of people. A soap that will form a large amount of lather is not on that account valuable, for cocoanut oil is often added to produce this result. The cost of a soap is a

better test of its value, as a good soap cannot be made very cheaply. The various soaps that are claimed to have soothing properties are not to be recommended on that account, as the most that should be desired of a soap is that it be simply pure and non-irritating.

Medicated soaps are of little use, although there were great hopes as to their usefulness when first they were introduced. No special curative effect can be due to a substance like soap which comes in contact with the skin for such a short time. Tar soap has a considerable popularity, especially for shampooing the head. For this it is generally pleasant and effective, but with the exception of its strong odor it does not possess any very unusual quality.

Sea Bathing.—There are numerous causes that make sea bathing beneficial, as well as a pleasure to the majority of people. The very fact that a bath in the ocean is enjoyable increases its beneficial effect, and, indeed, any exercise or recreation is of greater benefit if undertaken willingly and cheerfully and not as a tiresome matter of duty. The fine, pure air of the seashore is one of the important advantages of sea bathing. Breezes from the ocean are always fresh and free from disease germs, and are an invigorating tonic for healthy as well as for many sickly persons. The shock of the cold bath is always lessened by the exercise taken, especially if the bather can swim. The motion of the waves acts as a sort of massage to the body and adds invigoration to the bath.

It is rather doubtful whether there is any special virtue in the large amount of salt and greater density of sea water. Very little if any salt can be absorbed through the skin, and this alleged advantage of sea bathing is mostly in the mind of the bather. Many persons abuse the practice of bathing in the ocean by remaining in the water until their fingers and lips are blue and their teeth are chattering. All are not alike able to bear cold water, and convalescents or persons with serious organic disease should bathe only under medical supervision. One should never remain in the bath until thoroughly chilled. Ten to twenty minutes is amply long. The morning is the best time to take the daily bath in the ocean, as its general purpose is to be invigorating, and it is also most conveniently taken when the water is at high tide. After bathing in the salt water many find a brief shower or sponge bath of fresh water agreeable. When the bathhouse is provided with an inner courtyard for sunning oneself in it is healthful to lounge about in the sun for a while and allow the air as well as the sunlight to come in contact with the skin, and then to dress leisurely.

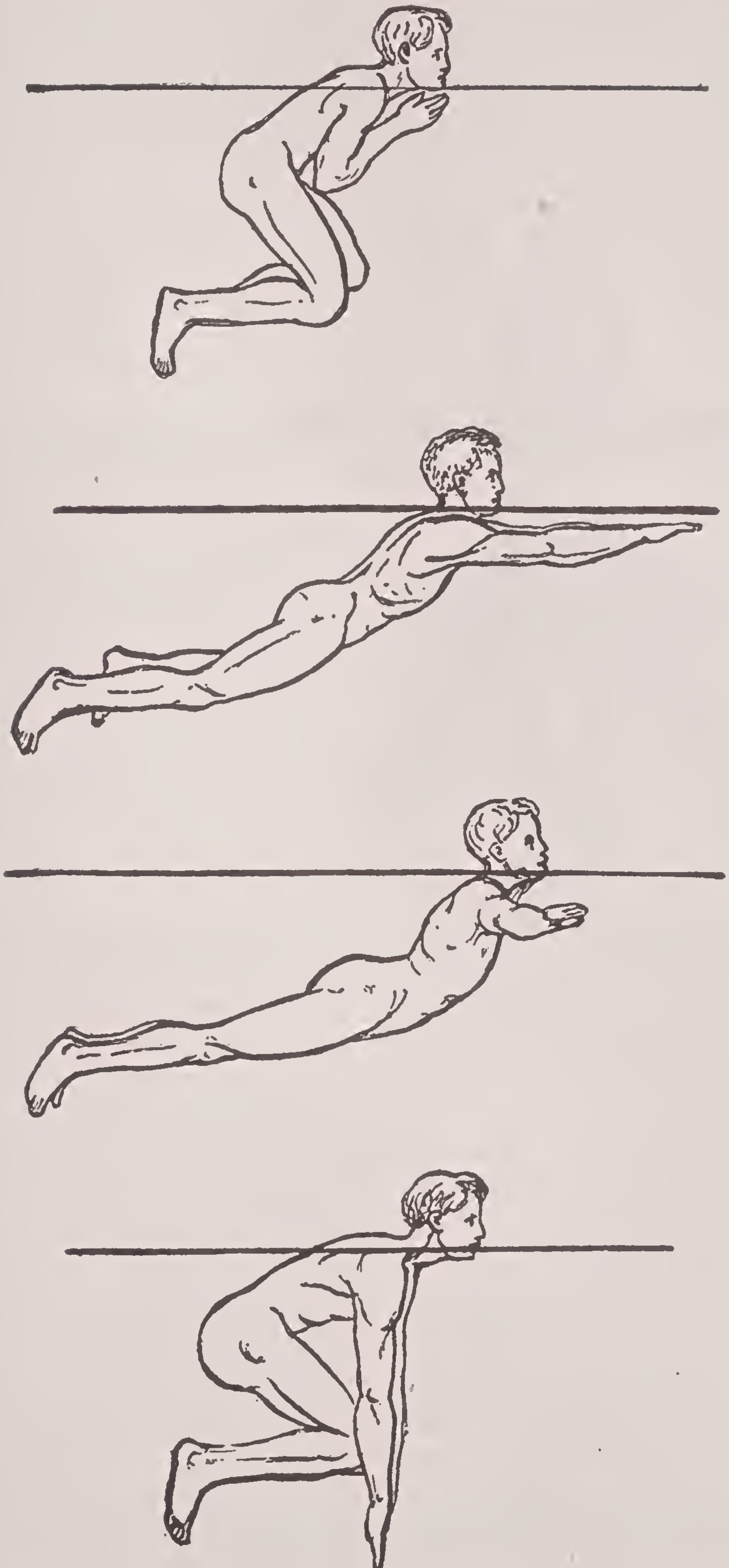


Fig. 56. The position and movement in swimming as seen from the side.

The word "bath" does not refer solely to an ablution with water, but also means surrounding the body with any medium whose quality or temperature is unusual. Thus there are the hot-air bath, the hot-vapor bath, the compressed-air bath, etc.

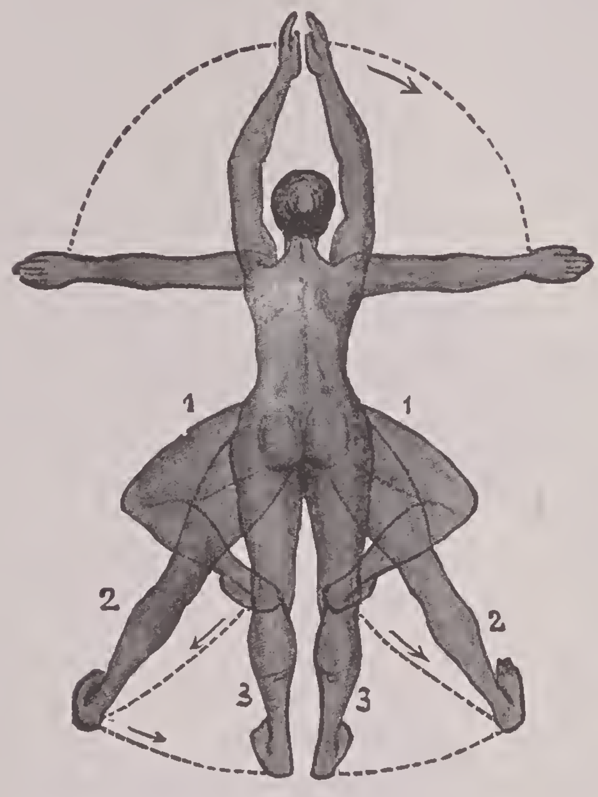


Fig. 57. Movement of the arms and hips in swimming shown from above. Note that the feet are kicked outward and back and then the legs are brought together. The thighs are widely separated at 1, but are brought together as the stroke is made. The effect is to press on the water between the legs, pushing it back and thus propelling the body forward.

The Turkish or hot-air bath serves several useful purposes, and is well borne by the average healthy person. Its systematic use may at times be advantageous, although it is for many an expensive luxury and it is not accessible outside of cities. In taking a Turkish bath, the bather removes his clothing, enters the **warm** room where the temperature is only a little above that of the body. Here he remains for a short time till a gentle perspiration appears upon the skin. He next enters the **hot** room, where the temperature ranges from 120° to 140° F., and sometimes a still hotter room is provided where the temperature may exceed 170° F. Upon entering the hot room the inexperienced bather often feels a sensation of nausea or suffocation; but, as a rule, in a well-ventilated bath these uncomfortable feelings will vanish with the appearance of a free perspiration. A practiced bather suffers no inconvenience in the hot room, and perspires much more freely and much more quickly than the beginner. Drinking a glass of water before or during the bath aids perspiration greatly. After leaving the hot room the bather goes to a moderately cool room and lies down while the attendant lathers him from head to foot and

scrubs and massages him vigorously. This removes all the loose epithelial scales, and as a means of cleansing the skin the Turkish bath is without an equal. The soap is removed by a douche, beginning with warm and ending with cold water. The bather may then take a plunge in a tank of cold water if this is available, or immediately go to a cool room and lie down for a half hour or more wrapped in a blanket. Persons who are exhausted from great exertion and whose muscles and joints are sore and stiff find the Turkish bath most refreshing. Many sufferers from rheumatism derive relief from a systematic course of such baths. The Turkish bath will often break up a cold; also one must be careful not to take cold after it.

The Russian bath differs from the Turkish in that hot vapor is used in place of the hot air. Perspiration cannot take place as readily in the Russian bath, and for producing a copious sweat the Russian bath is not equal to the Turkish. It is useful in some cases of chronic rheumatism, and is especially beneficial for dry forms of bronchitis.

Bath-pruritus.—A disagreeable and annoying result occasionally produced by bathing is called "bath-pruritus." There is a sensation of burning, or more often itching, chiefly confined to the lower extremities, which appears very shortly after a bath. It varies from a few minutes to a half hour in duration. It may follow bathing in salt or in fresh water. The itching seems to be aggravated by too long continuance or by extremes of temperature of the bath; by the use of soap that is too strong or that is allowed to remain upon the skin. Scratching seems to increase the pruritus. The affection is likely to occur in persons with a naturally irritable skin and a tendency to urticaria (hives). Most persons who suffer from itching after a bath must look for the cause in a natural irritability of the skin rather than in the bath itself.

The treatment, which is not always satisfactory, is based upon general principles. Any digestive or nervous disturbances are to be corrected, and a restricted diet and plenty of exercise are to be followed. The intestinal action should be kept free by laxative food or medicine. The bath should not be of long duration, and a good toilet soap should be employed. After the bath it is well to dry the skin gently without friction, and then to apply freely some dusting powder, such as equal parts of starch and zinc oxid or talcum powder.

Taking Care of the Complexion.—The face should receive no less than two washings daily. Cold water should be used, as it has a stimulant action on the blood vessels and improves the circulation in

the skin. It also improves the tone of the elastic fibers of the skin and delays the appearance of wrinkles. Furthermore, the general sensation of bathing the face with cold water is most refreshing. If the water is so cold as to be disagreeable, its temperature may be raised slightly; but it is not well to use hot or warm water regularly for washing the face. Using hot water upon the face and then exposing it to cold air or wind, especially in winter, has a decided tendency to produce chapping and roughening of the skin.

The **use of soap** is questionable for the daily cleansing of the face. For the perfectly healthy skin soap is not essential, and its too frequent use may prove injurious. For persons, however, with a very oily skin, or for those living in cities where the air is laden with soot from the use of soft coal, the daily use of soap may be necessary. If the complexion is sallow and there is a tendency to pimples and blotches, nothing serves better to stimulate the circulation and to improve the complexion than vigorous pinching of the face with the balls of fingers.

As to the advisability of using toilet creams and lotions, and the various complexion or face powders, if the skin is unnaturally dry, there can be no harm in the application of a little grease to the face, while the employment of powder is largely a matter of taste. In hot weather the application of a small quantity of rice powder to the face is often grateful, and does no harm to the complexion.

Cold creams are mixtures of a solid fat as wax or spermaceti, with an oil such as castor or almond oil, to which some fragrant substances are added. They can be used on the face with perfect freedom and safety. **Toilet or face creams** are mucilaginous preparations containing tragacanth, and are pleasant applications for a cracked or chapped skin. **Toilet lotions** serve a similar purpose, and are generally transparent or clear preparations containing **glycerin** and other substances.

For summer freckles and tan the following lotion is useful:

R.—Sulphocarbolate of soda	50 grains
Glycerin	2 ounces
Alcohol	1 ounce
Rose-water	1 ounce

For obstinate freckles the following is excellent:

R.—Bichlorid of mercury	6 grains
Alcohol	1 ounce
Glycerin	2 ounces
Oil of lavender	10 drops

Face powders contain one or more of the following: Talcum, starch, bismuth, chalk, zinc oxid, and magnesia, and, as a rule, are entirely harmless. Lead has at times been employed as an ingredient of face powders, and is objectionable from the possibility of a poisonous effect.

Wearing Apparel.

The materials used for clothing are obtained partly from the animal and partly from the vegetable kingdom. From the former are obtained silk, wool, furs, felt, and leather, while from the latter come cotton, linen, and rubber. Two important physical properties of clothing materials are their power of conducting heat and their capacity for absorbing moisture.

The heat-conducting power which a garment possesses does not depend to any great extent on the material itself, but chiefly on the manner in which it is woven. Dry air is a very poor conductor of heat, and any fabric which is loosely woven and holds considerable air in its meshes is a poor conductor, and consequently feels warm. Wool, for the reason that it is usually woven into cloth that is loose in texture, is a most valuable clothing material for cold weather. If numerous thicknesses of woolen clothing do not suffice to withstand severe cold, then furs may be added. Cotton is naturally woven into a fabric whose texture is compact and not porous, and is, therefore, not so suitable as wool for use in cold weather. When, however, specially manufactured so that its texture closely resembles that of woolen cloth, it may be a fair substitute for wool, as in the so-called "flannelette."

The property of absorbing moisture is possessed by wool in a very high degree, silk being next to it in this respect. Linen is only moderately, and cotton very slightly, hygroscopic or water-absorbing. A woolen garment can absorb a great deal of moisture without feeling wet. Evaporation of moisture goes on slowly from woolen clothing, while cotton clothing, especially underwear, speedily becomes saturated with moisture and evaporation may take place suddenly, causing chilling of the body. In speaking of flannel, the paradoxical remark has been made that "no matter how cold and wet it may be it is always warm and dry." As flannel underclothing is so hygroscopic and does not allow the moisture it absorbs to evaporate too rapidly, it is the most useful material for underwear in temperate and changeable climates. For cold weather, heavy woolen underwear cannot be equaled for warmth and comfort. By manufacturing cotton into

cloth with large meshes or air-containing spaces a very fair substitute for flannel has been produced. While probably not superior to flannel for underclothing, this fabric is acceptable to persons who find wool next to the skin uncomfortable. Many, however, who think at first that they cannot bear wool next to the skin, can, with a little patience, soon tolerate its presence quite well. Another substitute for woolen underwear is found in merino, which consists of a mixture of wool and other materials.

Woolen underclothing has the disadvantages of shrinking much when washed and of absorbing odors readily. The former objection can be somewhat overcome, however, by buying goods which have been already shrunken and by having them washed in tepid water, with little soap and no violent friction. On account of this tendency to shrink, old flannel underclothing is not the equal of new, for after repeated washing the fabric becomes "felted," less porous and of a closer texture, and consequently not so warm.

Clothing in Cold Weather.—It is a mistake to try to endure cold weather without wearing sufficiently warm clothing. Whenever a feeling of cold or chilliness is experienced it is highly advisable to put on an extra garment without delay, and it is folly to wait till the body is chilled before taking the trouble to make a change of clothing. The habit of wearing thin clothing all the year round and of going without an overcoat through the winter to display a vigorous constitution is not the part of wisdom. It is true that some persons seem to keep well from such a course, and while the heat-producing power may be equal to the extra demand, it is at the expense of the nervous energy of the individual. Children and old people, whose power of producing heat is limited, should be proportionately warmly clad, and the practice of dressing children with the legs exposed is as cruel as it is unhygienic and unsightly. A safe rule in regard to the amount and warmth of clothing for winter is to dress comfortable for the house and to put on extra outer garments to go out in, suiting these latter to the weather at the time, It is wrong to be dressed too warmly in the house and many people are subject to frequent colds just from the habit of wearing heavy flannels in winter. When the house is suitably warmed the same weight underwear may be worn the year round.

Clothing in Warm Weather.—In tropical climates flannel underwear is too warm. Cotton, silk, and linen are more serviceable materials. The Chinese plan of wearing a net next to the skin, and over it a thin silken garment, is admirable; the silk readily absorbs

the perspiration, and the net prevents the silken garment from adhering to the skin. Silk underclothing is agreeably soft and fresh, but is expensive and likely to shrink in washing. Much of the underclothing sold for pure silk is of mixed composition. Thin linen for hot climates is very acceptable. It always has a feeling of freshness, is more expensive than cotton, which is practically the most available material there is. Cotton is strong and durable, cheap, does not shrink readily, and absorbs odors very slightly.

The color of clothing is of considerable importance in regard to its warmth. If pieces of cloth of light and dark shades be placed upon snow it is found that the snow melts more readily under the dark than under the light cloth. This shows that light colors, such as yellow or white, which absorb fewest and reflect most of the heat rays of the sun, are the most suitable colors for tropical clothing. Cheap **aniline dyes** in underclothing and stockings may occasionally cause irritation to the skin, though less frequently than is generally supposed. By cleanliness and discarding the offending garment relief will very promptly be obtained.

Underclothing should be washed more or less frequently, depending on the amount of perspiring of the wearer. It should always be taken off and aired very thoroughly over night, and the same garment should never be worn both day and night. Damp underclothes are an excellent place for the growth of micro-organisms or germs, and favor the development of certain parasitic skin diseases which require conditions of warmth and moisture.

Rubber, oilcloth, or mackintosh clothing is useful to protect against wind as well as rain. It is suitable for persons whose occupation involves much exposure but not much exercise, as coachmen or seamen. For active occupations it is not suited. Being impervious to air, the perspiration cannot evaporate as it does through woolen garments. There is now made a form of waterproof cloth that differs from rubber in being entirely pervious to air. Overcoats made of this shed rain perfectly, and, unlike a mackintosh, feel quite comfortable when exercise is taken. As this material allows free evaporation of the perspiration it affords the ideal waterproof garment.

The unfortunate fashion of **long skirts** for women is certainly a very fruitful cause of poor health and often of positive acute illness. They not only stir up the dust and dirt as they sweep along, but they gather up disease germs and carry them into our dwellings.

Shoes.—There is hardly another article of clothing upon which our comfort depends so largely. It seems superfluous to say that shoes

should fit the feet perfectly, but owing to the demands of fashion, this is not always the chief consideration in choosing shoes. If expense does not prohibit, boots or shoes should be made to order. Standing

Fig. 58.
The effect of ill-shaped shoes: the big toe is forced out of its natural straight position.

Fig. 59.
The normal foot seen from below. Note that the big toe is in a straight line with the middle of the heel and of the main part of the ball of the foot, as indicated by *a b*.

in the stockings a tracing is made about the foot and from this the proper last is constructed. In well-made shoes the inner edge of the soles should be nearly straight and the toes not diverge greatly when

Fig. 60.
The foot spreads a little when the weight of the body is put on it. The dotted line shows how much the foot spreads. A well-fitting shoe should allow for this change of shape of the foot.

the wearer stands with the shoes together. The outer side should have a gentle curve, and the toe should never be pointed. In Fig. 61

Fig. 61.
Prints made by a normal foot and a flat foot showing that the normal foot does not touch the ground all along the inner side (big toe side), while the flat foot comes down on all parts of the sole.

is shown an impression made on a flat surface by the normal wet foot. A sensible form of shoe for feet of this shape can not rationally have

the toe narrow and pointed, nor, on the other hand, square as in some of the so-called common-sense shoes. The sole of a shoe should have

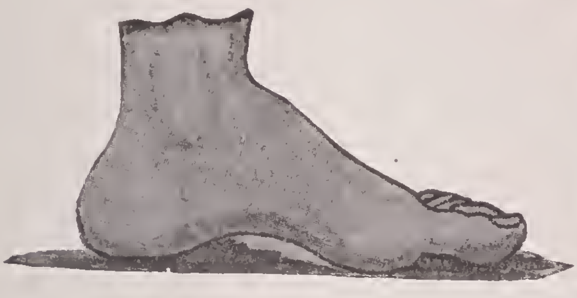


Fig. 62.
The normal foot, seen on its inner side. Note the arch upward in the middle. This gives a spring-like effect, reducing the jarring of walking.

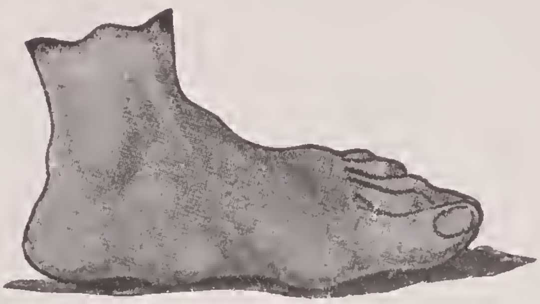
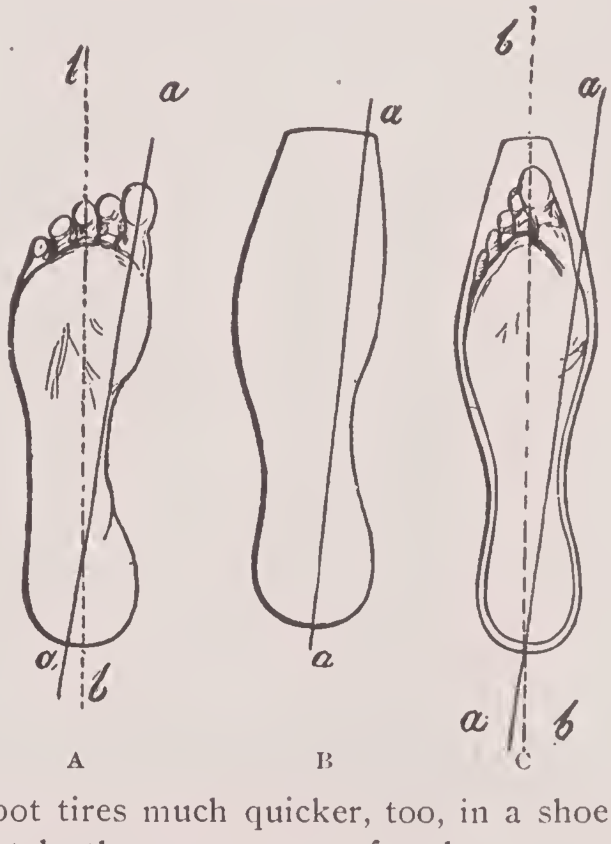


Fig. 63.
A flat foot or "splay foot." The arch has flattened out so that the inner edge of the sole rests on the ground.

the shape shown in Fig. 64. In Fig. 63 is shown a foot that has been deformed and made to fit a shoe whose shape is wrong and unhygienic (Fig. 66). The big toe is bent outward and a bunion is apt

Fig. 64.
A, The natural shape of the foot, *B*, a correctly shaped sole, and *C*, an ill-shaped sole with the resulting misshapen foot. *aa*, The line along which the foot acts in walking or running. The good sole, *B*, does not hinder this but the fashionable sole in *C* presses the big toe outward and makes the foot act along *bb*, in a cramped position that results in a bunion on the first joint of the big toe.



to form at its first joint. The foot tires much quicker, too, in a shoe of this shape, which is unfortunately the common one for shoes.

A shoe must be sufficiently long to be at all comfortable. A good rule is to wear shoes that are at least three-quarters of an inch longer than the foot. Observation of these common-sense ideas would avoid many troublesome conditions, such as corns, bunions, ingrown nails and "hammer toes."

The sole of the shoe should be of the extension form if to be used for hard walking; the projecting part protects against loose stones.

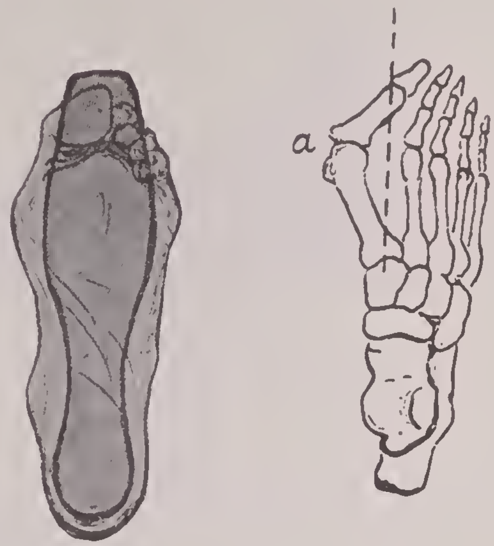


Fig. 65.
I shows the cramped, distorted shape of the foot in a shoe that is too small, especially too narrow. II shows the consequent displacement of the toes. The bones of the big toe are most affected and a bunion is apt to form at the joint *a*. The dotted line shows the position in which the big toe bones should be.

If the sole is flat, a much better support is given the foot than in the usual sole that turns up (see Figs. 66 and 67). The sole should be fairly thick for protection, but at the same time pliable.

Fig. 66. The *"rocker"* sole does not support the foot well.

Fig. 67. The *flat* sole gives a better support to the foot.

The heels should be broad and low. The high heels so frequently worn by women to increase their height and lessen the apparent size of their foot are harmful. They cause weakness of the foot through wasting away of the ligaments that give the proper arch to the foot.

Fig. 68.
The effect of "French" or high heels. The natural arch of the foot is distorted, and proper comfortable, graceful walking is rendered impossible. The shaded part shows the high heel and the displaced bones of the foot.

Low shoes are hygienic, for they allow ventilation of the foot, and are especially desirable during the warmer months. Patent leather shoes are not good for continuous wear, since, being impervious to air, they do not allow proper evaporation of the perspiration from

the feet. However uncomfortable rubber shoes may be, they often prevent colds; they should never be worn unnecessarily. For those who have to do much walking in wet weather and who cannot conveniently wear rubbers, hobnails are a great protection to the soles of the shoes, and also add to the firmness of the step.

Many foot troubles can be avoided by walking properly. The toes should be used even when the sole is heavy. One should walk "down through the sole," **i. e.**, should walk as if one had no shoe on, no sole between the foot and the ground. Flat-footedness is thus prevented. If the foot is becoming flat one should not toe out, but should walk on the outer rather than on the inner edge of the sole.

Socks and stockings are as apt to be ill fitting and to cause deformed and lame feet as are shoes. They should fit right, being of

Fig. 69.
The way ingrowing nail is caused. Too narrow a shoe or stocking, tilts the nail, *n*, up and forces it down into the flesh, and the irritation sets up inflammation and later suppuration in the part indicated by *a*.

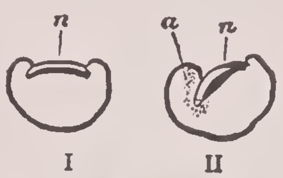


Fig. 70. The proper natural shape of the foot. Fig. 71. A proper fitting stocking. Fig. 72. An ill-fitting stocking, with too narrow a toe, which pulls the big toe out of its right position. Children's stockings should fit properly, because their feet are so easily deformed.

proper size and shape and should often be changed, the frequency depending on the amount of perspiration of the wearer's foot. Those who suffer from excessive perspiration of the feet, at times of a bad odor (so-called "bromidrosis"), the socks or stockings should be changed daily. It is a good habit to use two pairs of socks, alternating one pair one day and the other the next day. This is also a good

plan with footwear. The feet should be washed and dried without friction, and the feet and the fresh socks may be dusted with the following powder—salicylic acid, 1 part; starch, 4 parts.

Garters.—Ill-fitting shoes are not the only parts of human attire that bring about evil effects and are to be condemned. Any article of clothing which constricts any portion of the body is harmful and unhygienic. The circular elastic garter acts as a constant tourniquet about the leg and interferes with the circulation of the blood in the veins. These will dilate after awhile and become tortuous, giving rise to **varicose veins**. The dilated veins are sources of considerable annoyance, and at times of danger. Instead of using circular garters, the proper way is to suspend the stockings from some part of the underclothing or to use the long stocking suspenders which pass over the shoulders.

Corsets.—The subject of improper clothing can not be closed without adding a few words to the volume of protest already entered against the wearing of tight corsets. The fashion of compressing the body unnaturally by means of stays seems to continue in spite of the hostility and condemnation of practically all physicians. Constricting the waist too tightly causes a change in position of many of the internal organs and interferes with the functions of all. It prevents the proper muscular development of women, as no tightly laced woman can take vigorous exercise. Corsets greatly interfere with the full development of health and vigor. When tightly laced they lessen the amount of air that is or can be taken into the lungs. As a result the blood is imperfectly äerated, deteriorates in quality, and the corset wearer usually suffers from anemia.

The list of evils attributed to tight corsets is a formidable one, and should cause every woman to discontinue the practice of wearing them. Most women say that they would have a feeling of utter collapse if the stays were to be left off. This is due to the imperfect development of muscles that are not called into play when stays are worn, but which are essential to health. They should be strengthened by exercise in order to perform their natural functions and the corsets can then readily be dispensed with.

A certain writer has expressed opinions about stays that have given great consolation to women who wear them. She says that women breathe naturally with the chest, especially the upper portion, using thoracic or costal breathing, and employing abdominal breathing very slightly, so that tight lacing that does not interfere with chest breathing is hygienic and proper. Opposed to this view, an

experimenter finds that Indian girls who have never constricted the waist by stays breathe with the diaphragm as naturally as do men, and concludes that costal breathing, common in women, is itself not sufficient and is due to wearing stays. As a matter of fact, no good singing teacher would ever consent to allow his pupils to sing when handicapped by a tightly laced waist, but would insist upon their breathing to their utmost capacity. This can only be accomplished when both chest and abdomen are free and entirely unhampered.

Bed clothing should not be heavy. A light covering, such as an eiderdown quilt, will afford more warmth than a blanket of greater weight, because it has enclosed in it more air. Two coverings, on account of the layer of air between them, will be warmer than one which is equal to both in thickness. Bed clothing should be aired thoroughly every morning, being turned down and separated and the windows of the sleeping room being opened for this purpose.

CARE OF THE HAIR.

A fine head of hair is universally prized, yet is frequently neglected by its owner as often through ignorance as through carelessness. In the preservation of the hair some persons have a great natural advantage over others. An inherited **tendency to baldness,** as shown by a thin and poorly nourished scalp, causes greater difficulty in preserving the hair.

The scalp may be compared to the soil. Neither hair nor plants will grow luxuriantly if poorly nourished. A scalp which is favorable to the growth of hair is thick and pliable, and moves freely on the skull beneath. If the scalp is very thin, the blood vessels are few in number. If it is drawn tightly over the skull, the blood vessels will be narrow, the supply of blood to the scalp is scant, and atrophy of the roots of the hair results from lack of nourishment. The principal causes which bring about a premature thinning of the hair are heredity, a deficient circulation of the blood in the scalp, wearing too warm a cap, and the constant presence of dandruff.

Dandruff consists of epithelial scales mixed with dried sebaceous matter, and is the forerunner of premature baldness in many cases. It is present to a greater or less degree in many scalps unless it is constantly guarded against. It is highly important to keep the scalp clean and free from dandruff, and to this end daily brushing of the hair and frequent shampooing are necessary.

Hair Brushes.—The hair should be brushed morning and night for several minutes until the scalp feels warm and all particles of dandruff

are removed. The brush should be rather stiff, with the tufts of bristles well separated to facilitate cleaning. For children and for very sensitive scalps, softer brushes must be used. Brushes should never be so stiff nor the brushing so vigorous as to cause any soreness of the scalp. Brushes should be frequently washed in water containing a little ammonia, and then dried in the sun with the bristles down or the brush is better hung up to turn in the sun.

Combs are useful for disentangling snarls and for dressing the hair, and may be used daily with the brush. The teeth should be wide apart, have blunt ends, and the spaces between should be kept scrupulously clean. The old-fashioned fine toothed comb pulls out the strong hairs, especially if the growth is luxuriant, and the fine points may produce disease of the scalp from irritation. Its use should be limited to the removal of vermin, but even for this purpose a wash of 1 part of corrosive sublimate in 500 of water is much more advisable. The hair must be well rinsed afterwards. The corrosive sublimate is a strong poison and must be thrown away after use.

Many persons fear that any considerable amount of **brushing and combing** will cause a serious loss of hair. The effect, however, is just the opposite. It increases the growth of hair by stimulating the circulation and by removing dandruff. Brushing removes loose hairs which are ready to fall, but their place is soon taken by new and more vigorous ones. The groom knows that the only way to keep the coat of his horse thick and glossy and in a healthy condition is by constant use of the currycomb and brush, and that he is not likely to use either too much.

Shampooing.—Many naturally have a luxuriant growth of hair and who perhaps consider themselves safe to baldness, grudging giving any time to the care of their hair and consider shampooing especially distasteful and unnecessary. To keep the hair clean and free from dandruff, shampooing occasionally is very necessary.

Shampooing, like brushing, removes some loose hairs, but by cleansing and stimulating the scalp it is a most important means of preserving a good head of hair, of aiding in restoring it after a temporary falling out. The frequency of shampooing the scalp depends on the rapidity with which dandruff forms, and to some extent on the occupation of the individual. For some persons, washing the scalp once a month is sufficient to keep it in a proper and hygienic condition. Others, and especially those who travel much or are exposed to dust and dirt, may find it necessary to wash the head once a fortnight, or even once a week. There is never any danger of sham-

pooing the healthy scalp too often, notwithstanding the statement to the contrary so frequently made by some hair dressers, whose chief stock in trade is some "tonic" of alleged miraculous virtue. When the hair has begun to fall out prematurely, due to long neglect or following an illness, it is well to shampoo the head twice or even three times a week, and gradually to lessen it to once in three or four weeks.

Some are afraid that the shampoo will not only cause considerable loss of hair through the friction employed, but they fear that all the oil in the scalp will be removed and great damage done to the hair by the resulting dryness. Immediately after washing the scalp, especially if alcohol be used in addition to the soap, the scalp will certainly feel dry, but it will soon become more oily than usual, owing to improvement in circulation and consequent increased activity of the oil glands. This will be the result in the majority of cases, and very few persons will suffer from dryness of the scalp if they shampoo often enough. Some persons say that after the shampoo the scalp actually becomes too oily. When the scalp fails to respond to the mechanical stimulus of shampooing and does not produce a sufficient amount of sebaceous matter, then it is well to rub into the scalp some form of grease or oil. Nothing answers this purpose better than pure vaseline, although some barbers prefer olive oil. This can be conveniently applied by a medicine dropper, making numerous partings in the hair. The use of soap on the hair agitates some people who, though using the best soap in cleaning the skin, consider that shampooing is dangerous unless the soap used is recommended by a physician. Any good toilet soap on the market will answer and more harm is done by refraining from the shampoo than by using an inferior quality of soap for it.

Alcohol added to **shampooing liquids,** as in the **tincture of green soap,** greatly assists the thorough cleansing of the scalp. The addition of an egg to the shampoo makes it more pleasant and effective. The egg has no cleansing effect and its use is largely a matter of taste. There is no more reason for its use upon the scalp than in the daily washing of the hands and face.

A very satisfactory shampoo liquid consists of 50 parts of good soft (or green) soap, 2 parts of oil of lavender, and 33 parts of alcohol.

For shampooing any ordinary good toilet soap may be selected. A lather is formed and rubbed vigorously into the scalp with the finger tips or a stiff brush, a nail brush being very convenient for the purpose. The lather is best removed by a warm water douche,

always ending with cold water to lessen the danger of taking a cold. The hair is then to be dried as thoroughly as possible with towels, and to complete the drying one should remain for a time in the sun or near an open fire or a radiator.

Headgear.—Many persons not only naturally possess thin hair and a poor circulation, but they are subject to various conditions that tend to interfere with the health of the scalp. One of these is the wearing of hats. The hats worn by men at the present time, especially the Derby or Christie and the silk hat, allow very little ventilation, prevent the access of sunlight or air, and do not permit proper evaporation of the perspiration. The tight fitting brim constricts the blood vessels and thus hinders the circulation. Women's hats have no tight brim, allow free ventilation, and, unless very heavy, are seldom objectionable from their weight. Savages who go bareheaded do not suffer from baldness, and the same is true of the lads of the "Blue-Coat School" in London. These boys never wear any hats, however stormy or cold the weather may be.

The hats of the present day seem to be necessary evils, and the only practical advice is that they should not be worn unnecessarily, especially when the head is perspiring, and that they should not be jammed on the head with such firmness as to interfere with the circulation of the scalp. The fact that women are more free from baldness than men may be due in a slight degree to their wearing a more hygienic headgear, but undoubtedly the chief cause lies in their possession of a thick scalp and underlying layer of fat, which is naturally better adapted to support a good growth of hair. It is probably also natural for woman to have an abundant growth of hair on the head, owing to evolution.

The **amount of brain work** done may be a factor in causing premature baldness, but this has not been definitely proved.

Mechanical stimulation is the best means of improving the circulation and stimulating a good growth of the hair. This may be done through shampooing, massage, and by the local application of electricity or by any one of these. Shampooing thoroughly and frequently cannot be too strongly urged.

Massage of the Scalp.—Vigorous daily massage, if continued for a considerable time, will improve the circulation and increase the growth of hair. If the scalp is pale and thin, it should be massaged with the finger tips a few minutes with the daily morning and night brushing. A variety of motions may be practiced, such as gently rubbing the fingers over all parts of the scalp, and then placing them

firmly on the scalp and moving the scalp itself over the bones beneath, proceeding from the top of the head and going in the natural direction of the hair.

Electricity acts merely as a local stimulant to the circulation, and is best used in the form of galvanism. A wire brush electrode, attached to the negative pole of the galvanic battery, is applied to the scalp until it becomes well reddened.

Cutting the Hair.—Many persons wrongly believe that cutting the hair increases its thickness. It may aid slightly the rapidity of growth, but cutting certainly does not increase the number of hairs. To keep the hair short in children up to the age of eight or nine years of age is sensible and hygienic. The good effect is mostly due to the easier access of air and sunlight to the scalp and to the greater ease with which the head can be kept clean. Some think that if the hair of a child is kept short there will be less of a tax upon the strength and vitality.

That **shaving** with a good razor produces a thicker and coarser growth of hair is generally accepted. A recent writer on hygiene, however, claims that shaving actually has a depilatory (or hair-destructive) effect. In shaving, the roots of the hairs are stimulated to a slight degree, and a coarser and thicker growth upon the face of a young man doubtless results in due time; but **time rather than shaving** may be responsible for the change. Enthusiasts sometimes shave the head in the hope of obtaining a better growth, but this is never productive of any brilliant result and is absurd and useless, unless in so far as it enables the scalp to be kept clean and exposed to the air.

In **dressing the hair** violent pulling upon the roots must be carefully avoided, as this loosens and causes a falling of the hair. There should be no uncomfortable twists or knots which are certain to prove injurious in time. There is no great objection to **curling the hair** if it is not done too vigorously. Curl papers, if not put on so tightly as to pull on the roots of the hair do no harm. Curling irons, however, are apt to be overheated and to make the hair too dry and brittle.

A very absurd idea of the average "tonsorial artist" is that **singeing the hair** will preserve it and stimulate its growth. There is no truth in the assertion that a hair is a hollow tube which allows the escape of oil, and that if the ends be sealed by singeing much benefit will result. **Hair restorers or hair tonics** are quite as useless as singeing. These much advertised preparations fail utterly to accomplish the pur-

pose for which they are employed. Shampooing, brushing, massage of the scalp, attention to the general health, and not the use of a hair tonic, are the only means of preserving a good head of hair and of aiding its renewal after falling out.

Pomades in general are unnecessary, and to most people they seem uncleanly and disagreeable. A generation or two ago some oily dressing for the hair was universally used, largely because it was the fashion. Bear's grease was often used as an ingredient in the hope that some hair-restoring properties might be possessed by the fat of an animal naturally so hairy.

Men frequently **wet the hair** to make it lie smooth. Besides having a doubtful esthetic effect, this practice is harmful by causing decomposition or softening of the roots of the hair. There is no harm in washing the hair frequently if it is dried with towels.

Removal of Superfluous Hair.—The use of depilatory pastes (substances to remove superfluous hairs) is not wise, except under the advice of a physician. These pastes may remove a downy growth of hair, but cannot remove large stiff hairs without doing too much damage to the skin. For large hairs, the only satisfactory method of removal is the slow but sure one by **electrolysis.** An experienced operator can permanently remove any number of large hairs without leaving any scars or causing much pain.

Gray Hair.—It has been remarked that the only sensible thing to do for gray hair is "to admire it." Gray hair undoubtedly improves the looks of some people and is welcomed by them, but to others it is a source of annoyance. In the rare cases of sudden blanching of the hair, which sometimes follows great mental disturbance, a return of the former color is often possible, but even this cannot be aided by any efforts of the physician. Only the measures advised for the general care of the hair are necessary. Nothing can really be done to prevent hair turning gray.

Dyeing the hair is in poor taste, and is very rarely excusable. Many dyes for coloring the hair black contain lead and should be avoided, as lead-poisoning from the use of such undoubtedly have occurred.

Before the application of a hair-dye the head should be well shampooed and dried. The dye is most conveniently applied by a toothbrush, contact with the scalp being avoided.

The following harmless hair-dye produces a **black** color:

Bismuth citrate	1 ounce
Rose water	2 ounces
Distilled water	2 ounces
Alcohol	½ ounce
Ammonia water	a few drops

To be applied in the morning.

Sodium hyposulphite	1½ ounces
Distilled water	4 ounces

To be applied at night.

A **brown** color may be got by using a mixture of pyrogallic acid and rose water.

Care of the Beard.—As much care should be given to the cleanliness of the beard and mustache as to the scalp. The frequent washings of the face during the day should include both beard and mustache. To give softness and luster to the mustache "brilliantines" may be employed without risk of a harmful effect. A suitable formula for such a preparation is glycerin, castor oil, and alcohol in the proportions of one, two and three respectively, to which a small amount of perfume may be added.

Of **shaving** it may be said that it is always a good plan for a man to shave himself and so avoid any possible risk of infection from the barber-shop. A number of diseases may be got in the barber's chair, notably ringworm. This affection, so obstinate when it attacks hairy portions of the body, is usually got from the use of a damp towel, less often from the shaving-brush, the "clipper," or the hands of the barber. The razor is not at all likely to be the source of infection. The damp towel is a most excellent medium for the growth of the ringworm parasite, as this fungus, much like ordinary mould, requires moisture for its growth. When a barber-shop is patronized regularly, one should have a private cup, shaving-brush and razor. If the towels used are perfectly clean and dry, and the barber washes his hands thoroughly before shaving each customer, there will be very little danger of ringworm and other infectious diseases.

Care of the Nails.—The proper care of the nails depends upon a very few and simple rules. The skin overlying the root of the nail tends to encroach too far over the lunula, or white area at the base, and is apt to become torn and ragged, by which so-called "**hangnails**" are formed. These little openings through which infectious matter may enter and do a good deal of damage may be not only painful but are also dangerous, as it is possible for blood-poisoning to result

from infection through one of them. The epidermis over the root of the nail should be pressed back once or twice a week with a suitable instrument. For cleaning the nails, nothing but soap, warm water,

Fig. 73. The finger-nail bed; nail removed.

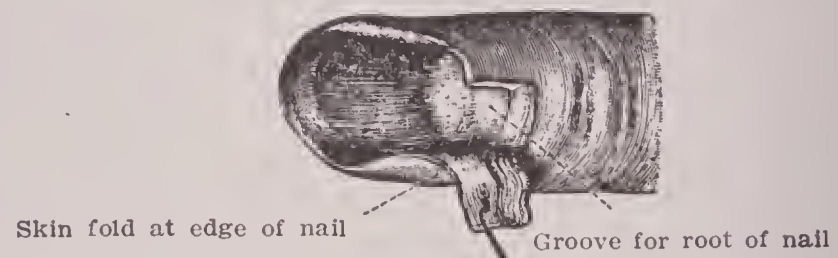


Fig. 74. The bed of the nail as shown by removal of the whole nail.

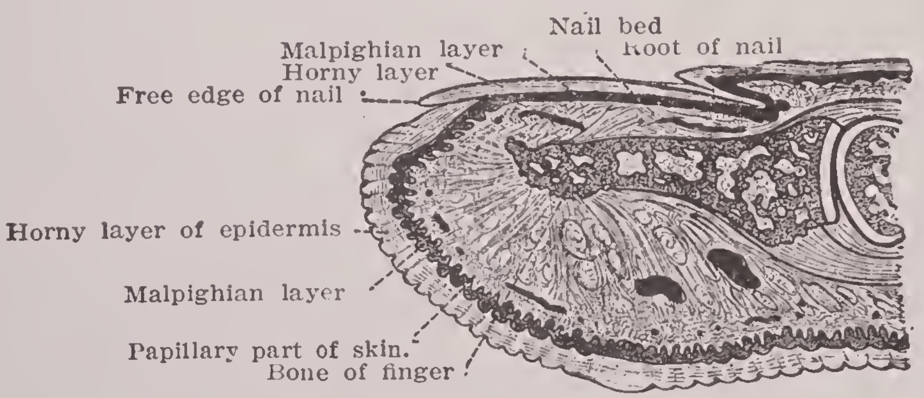


Fig. 75. Section lengthwise through the end of a finger. Enlarged.

and the nail-brush are usually necessary or should be employed. The penknife should not be used as a nail-cleaner, as it scratches the under surface of the nail and makes a place for dirt. The surface of the nail should never be scraped, except in the case of thick, hard, ingrown nails, which should be scraped thin.

To **remove stains from the nails** a mixture of one part of acetic acid and sixteen parts of rose water may be employed. Oxalic acid is perhaps more efficient for this purpose, but its use is not desirable, because it is poisonous.

The Digestive Canal

Extending from Mouth to Rectum.

Subject Reference

For Organs of Digestion and Excretion, see Vol. 1, pages 45 to 55; also pages 340 and 401.

For Nutritive Principles, Vol. 2, pages 648 to 679.

For Obstruction of Intestines, Vol. 2, pages 208 to 218.

Diseases of the Stomach, Vol. 2, page 399. Diseases of the Intestines, Vol. 2, page 409.

How We Digest, Absorb and Assimilate the Nourishment to Sustain the Body.

The Mouth, Throat, Gullet, Stomach, Small and Large Intestines. The Elimination and Evacuation through the Skin, Lungs, Bowels, Kidneys, Etc.

Process of Digestion.

The various processes through which food passes are:

1. **Selection** and **preparation** (including usually cooking).
2. **Ingestion**, or taking it into the mouth.
3. **Mastication**, or **insalivation**.
4. **Deglutition**, or swallowing.
5. **Digestion**, or conversion into soluble forms that can be absorbed. (The term "digestion" is also used in a wider sense to include all the changes to which the food is subjected.)
6. **Absorption**, or taking the digestion products into the blood-vessels and lymphatics.
7. **Distribution** in the blood to all parts of the body.
8. **Assimilation**, or building into the living tissues to repair waste or to cause growth. A part of the food may be utilized for the production of energy without being converted into living substance.
9. **Elimination**, or excretion, of the waste-products resulting from the activity of the living tissues. A part of the food is usually indigestible and passes on through the bowel and out of the body, constituting the solid **feces**.

Of these **various** processes we have direct voluntary control over the first four and indirect control, or influence, over all the others.

Mastication and Insalivation.—Digestion begins in the mouth with the mastication, or chewing, and insalivation, or mixing in saliva, of the food. Mastication is effected by the teeth and tongue, and at the same time insalivation goes on as the saliva is poured into the mouth

both above, at the cheek, and below, from the floor of the mouth under the tongue. Upon the thoroughness of the mastication the breaking up of the larger and more resisting morsels and the thorough admixture of them and the saliva, depends in no small degree the comfort and completeness with which the digestion in the stomach

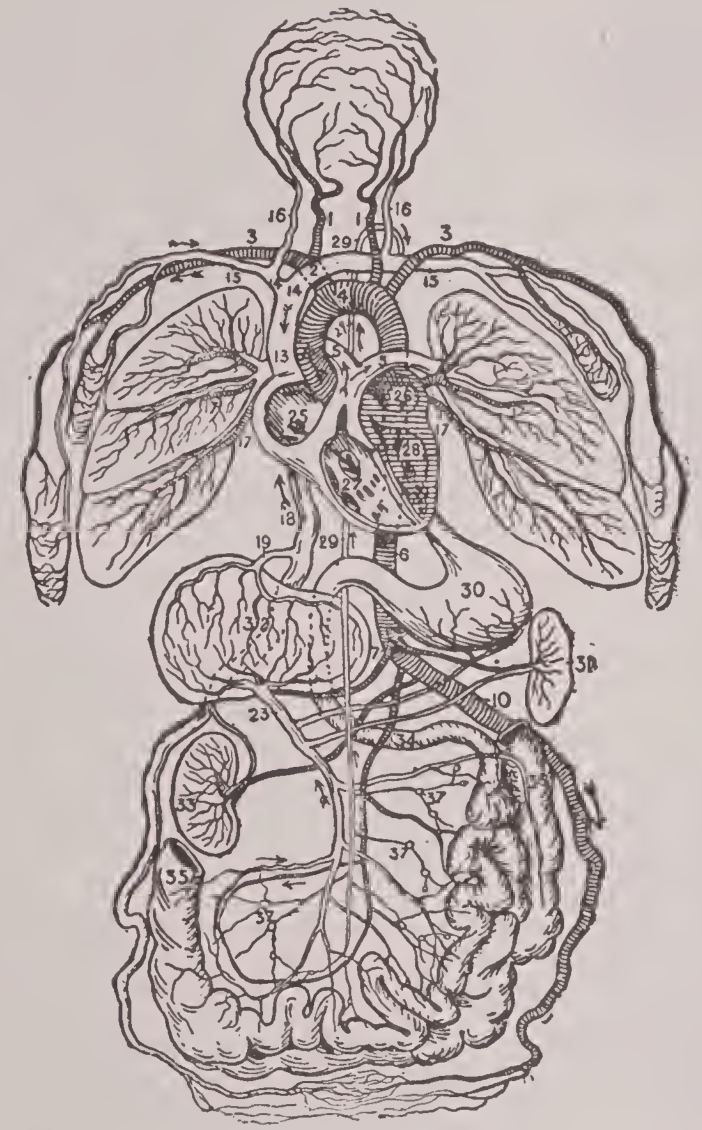


FIG. 76. DIAGRAM OF THE CIRCULATION OF THE BLOOD.

1, The carotid arteries. 2, The innominate artery. 3, The subclavian artery. 4, The arch of the aorta. 5, The pulmonary arteries. 6, The thoracic aorta. 7 and 10, The abdominal aorta. 13, The superior vena cava. 14, The right innominate vein. 15, The subclavian veins. 16, The internal jugular veins. 17, The pulmonary veins. 18, The inferior vena cava. 19, The hepatic vein. 23, The portal vein. 25, The right auricle. 26, The left auricle. 27, The right ventricle. 28, The left ventricle. 29, The thoracic duct. 30, The stomach. 31, The spleen. 32, The liver. 33, The kidneys. 34, The duodenum. 35, The ascending colon. 36, The descending colon. 37, Abdominal lymphatic glands.

is carried out. Starchy foods in particular require the effect of the **ptyalin** (a constituent of the saliva by the action of which the starch, especially when thoroughly cooked, is converted into **maltose**, a kind of sugar, and therefore **soluble**, which starch is not). The saliva enters the mouth from three separate sets of **salivary glands** on each side—the **parotid** at the angle of the jaw, just in front of the lower part of the ear; the **submaxillary** along the inner side of the jaw, and the **sublingual** under the tongue. The mouth is further moistened by the secretion of the numerous small glands in the mucous membrane with

which it is lined. The secretion of saliva is excited by the presence of foreign bodies in the mouth, but especially by food; also by the sight, smell, or even thought of food. The action of the glands is

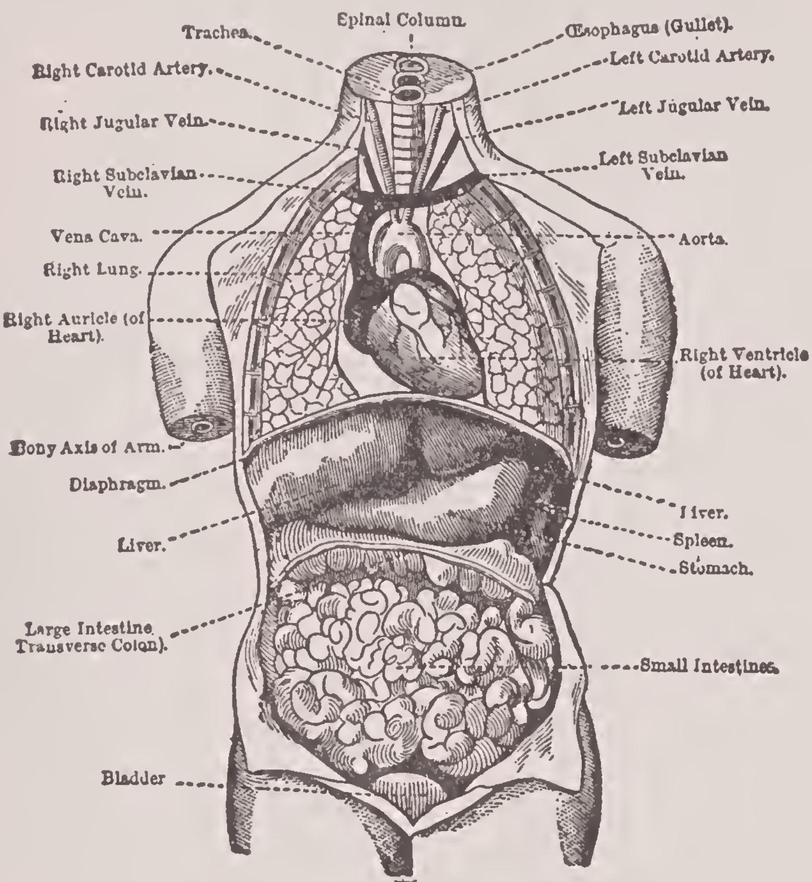


Fig. 77. The situation of the chief internal organs. A diagrammatic representation.

controlled by the nervous system, and the effect of the higher nervous centers upon their activity is evident in the free flow of saliva that follows the odor of certain substances, and the sight, or even thought, of others. The saliva is slightly alkaline and its activity in digesting starch differs in different individuals.

The conversion of starch into maltose (or grape sugar) by ptyalin (the ferment present in saliva) is slower in the presence of a slightly acid medium, and ceases in a free acid medium. If the saliva is diluted by water or other fluids, its activity is correspondingly diminished. Therefore solid foods should only be swallowed after they are thoroughly disintegrated by the teeth and sufficiently softened by the saliva to pass easily into the throat and through the esophagus to the stomach without the assistance of drink. It is a good rule to resist the impulse to swallow the food so long as the teeth can find anything to chew in it.

The stomach is a muscular sac, lying mostly on the left side of the

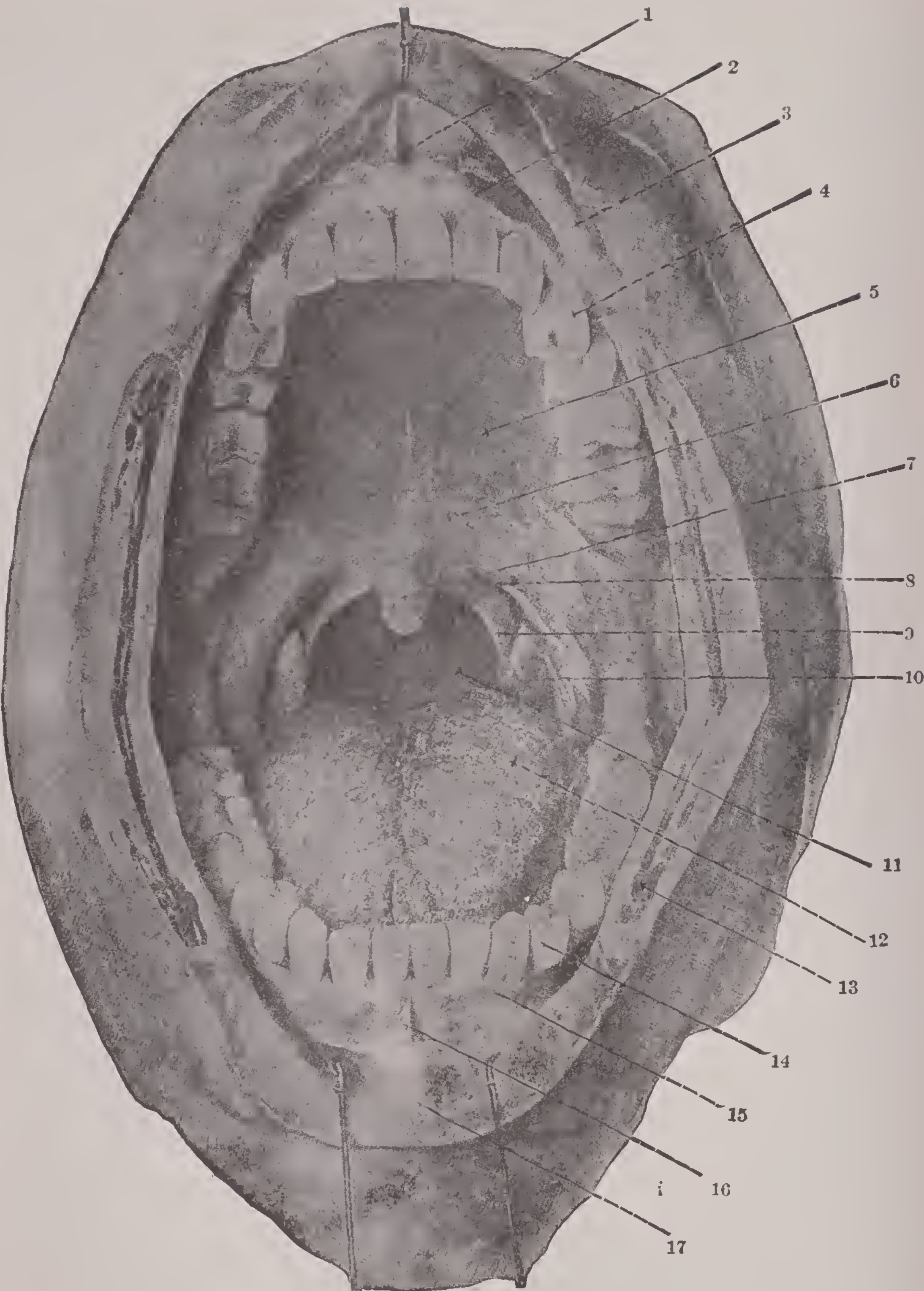


Fig. 78. 1, Frenulum ("bridle" or "check-rein") of the upper lip—a vertical fold which holds the lip to the gum; 2, gum—the firm covering of the jaw-bone; 3, upper lip; 4, upper dental arch or row of teeth; 5, hard palate; 6, soft palate—the hard and soft palate form the roof of the mouth; 7, uvula, a conical pendent part of the soft palate (the pointing line is half an inch short); 8, the anterior, and 9, the posterior pillar of the fauces (the fauces are the spaces between the mouth and the pharynx, enclosed by the soft palate above, and the back part of the tongue); 10, the tonsil (this lies in a hollow between the pillars of the fauces); 12, dorsum or back of the tongue; 13, cut edge of the cheek; 14, the lower row of teeth; 15, gum; 16, frenulum of the lower lip; 17, lower lip.

body and under the lower ribs. It also extends below the ribs and a little to the right side of the middle plane of the body. Its entrance, at the termination of the esophagus, is called the **cardia.** Its outlet into the duodenum is called the **pylorus,** and this is guarded by a

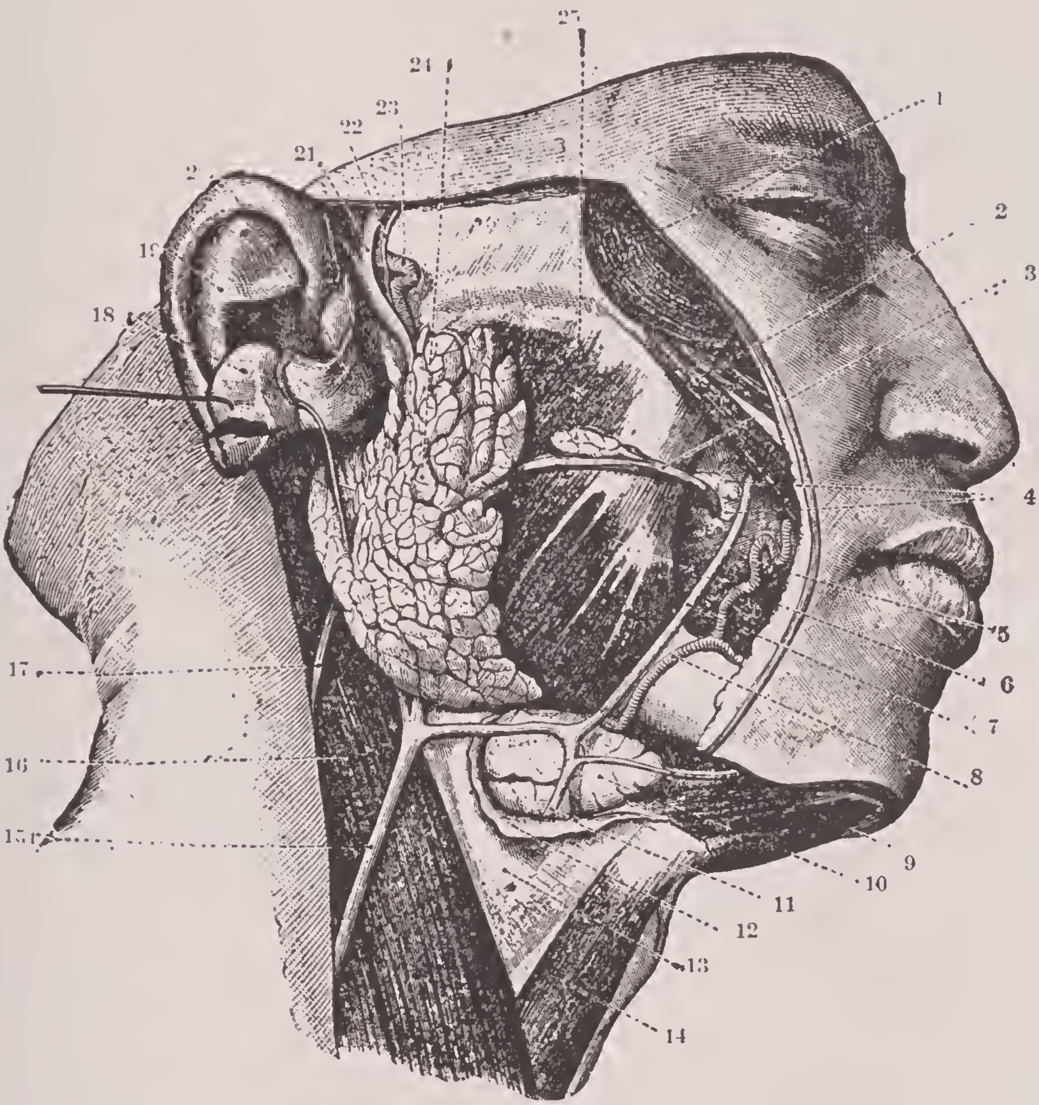


Fig. 79. The parotid and the submaxillary salivary gland on the right side. 1, Muscle which closes the eye; 2, One of the muscles which move the lips and give expression to the emotions. 3, Duct from the parotid gland to the mouth. 4, Cheek or buccal glands. 5, Cheek muscle (Buccinator). 6, Chewing muscle (Masseter); it helps to close the jaws together. 7, Vein of the face. 8, Facial artery. 9, Digastric muscle (helps to open the jaws). 10, Submaxillary salivary gland. 11, Common trunk of the facial vein. 12, Superficial layer of the fascia of the neck. 13, Deep ditto. 14, Sternohyoid muscle (from the sternum to the hyoid bone). 15, External jugular vein (the internal jugular vein is deeper in and lies beside the carotid artery. 16, Sternomastoid muscle (helps to nod the head and also turns it to the side). 17, Great auricular nerve (sensory nerve to back of ear). 18, Lobe of the ear (turned in). 19, Ear. 20, Cartilage of the ear. 22, Sensory nerve to temple. 23, Artery to region of the temple. 24, The parotid gland. 25, A small extra parotid gland.

strong band of circular muscle-fibers, the sphincter muscle of the pylorus, which close the opening so as to prevent the untimely escape of the gastric contents. It relaxes only at times to allow food or

fluid to pass on out of the stomach. The stomach is covered with a delicate **serous coat** (a part of the peritoneum), and is lined with a **mucous membrane.** Between these two coats lies a third, the **muscular** coat, which consists of three layers having different directions for the fibers of which they are made up. By the action of this muscle coat the food is mixed with the digestive fluid and moved on and around. Joining the mucous and the muscular coats is a loose fibrous layer, the **submucous** coat, which permits the inelastic mucous layer to wrinkle up and the muscular coat contracts, and to become again smooth as the stomach is filled. In the adult the stomach, when filled,

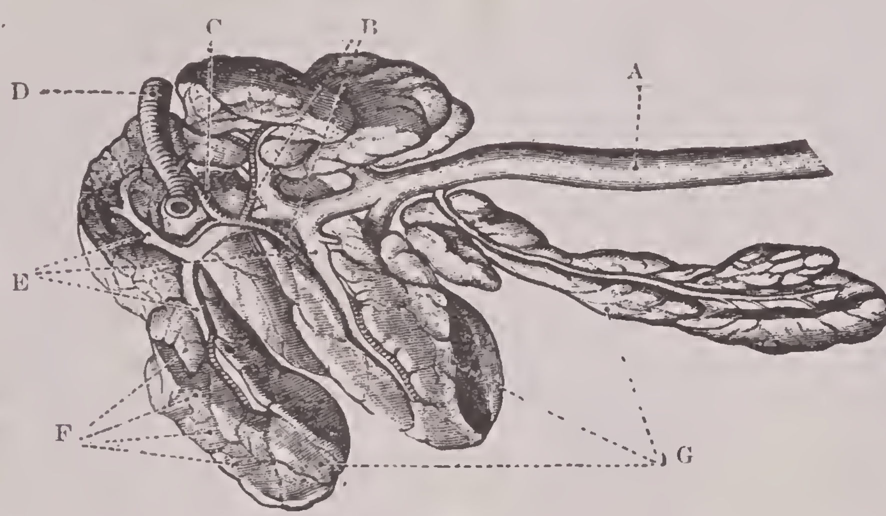


Fig. 80. The submaxillary salivary gland, to exemplify the structure of a gland. A, The duct or canal carrying the secretion (saliva) from the gland to the mouth (which it enters under the fore part of the tongue). B, Branches of the artery, for the lobules of the gland. C, Large branch of the main artery. D, E, Branches of the gland duct. F, Lobules ("little lobes") of the gland. G, Lobes or divisions of the gland.

contains from two to three pints or more, but owing to the action of its muscle coat it accommodates its size to its contents. It varies considerably in size and shape in healthy individuals. It is very richly supplied with blood-vessels and lymphatics. The veins empty into the portal system (going to the liver), not communicating directly with the general circulation. The mucous membrane secretes large quantities of fluid called **gastric juice,** which, besides much water and some mucous or slime, contains **hydrochloric acid,** and two ferments called, respectively, **pepsin and rennet,** or **lab-ferment.** During fasting the stomach is of a pale-pink color, and contains a small amount of fluid neutral in reaction; **i. e.,** neither acid nor alkaline. The pyloric or lower part of the stomach is translucent in its mucous lining, which contains numerous mucous glands. The gastric juice is secreted by the gastric glands proper. These are branched, tube-like structures, to which the mucous membrane owes its great thickness. With the

introduction of food into the stomach the mucous membrane becomes of a deeper red color, owing to the greater supply of blood, and the secretion of gastric juice becomes very abundant. As this secretion is acid in character, it might be supposed that the digestion of starch,

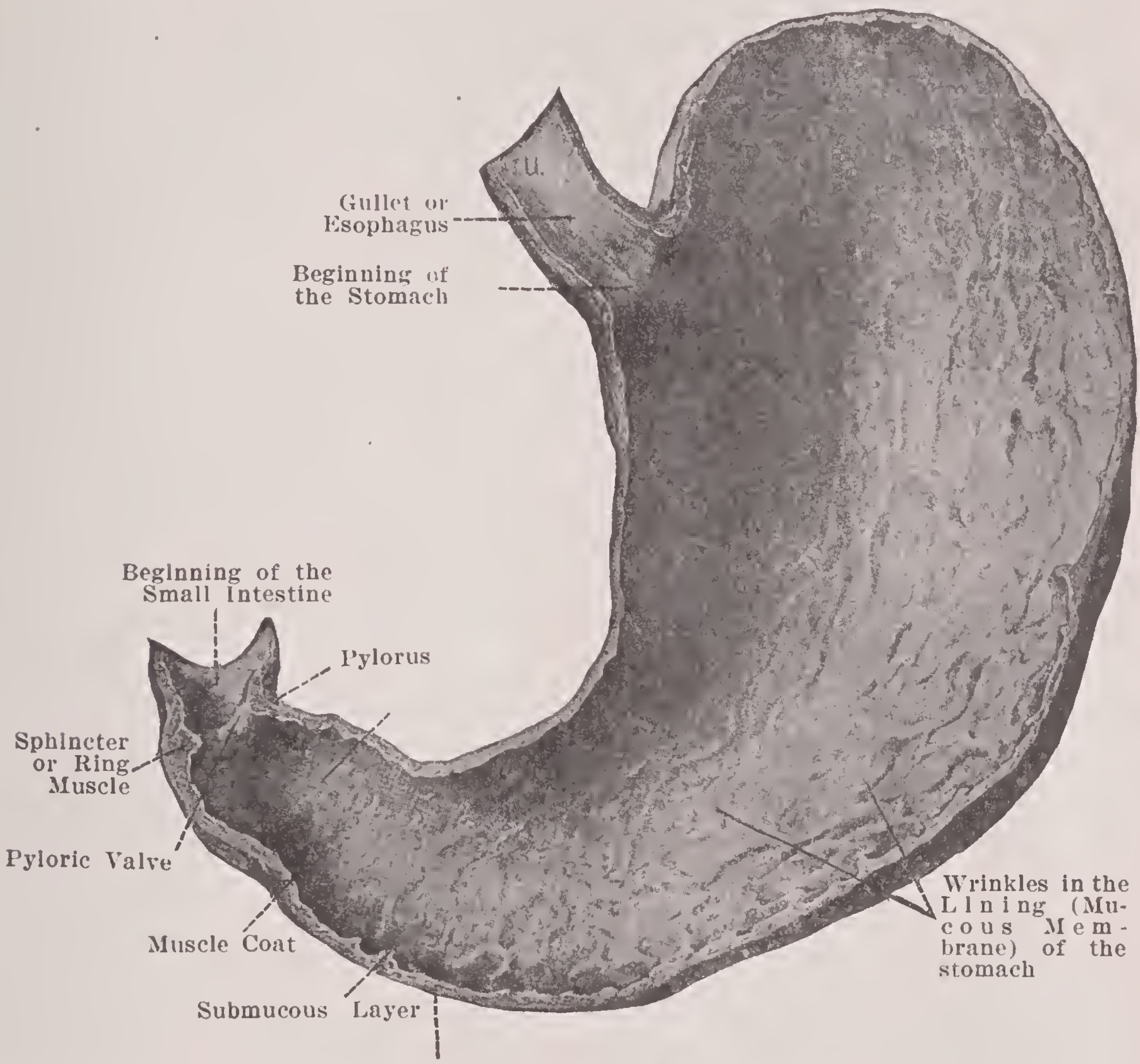


Fig. 81. The posterior half of the stomach to show the shape, walls, etc. The submucous layer is very loose and allows the lining to wrinkle inward as the muscle coat contracts on the outside.

begun in the mouth, would immediately cease in the stomach, since the ferment of saliva does not act in the presence of acid. Such, however, is not the case, owing to the fact that the earlier secretion of hydrochloric acid promptly combines with the albumin in the foods, so that free hydrochloric acid is not present in the stomach until some time after food is taken. A slight amount of lactic acid (the same acid as is formed in souring of milk) is found in the stomach at this time; but it mostly comes in the food, and is not due to secretion, although to some extent it may come from fermentation even in the

healthy stomach. After the lapse of a certain period of time (varying in individuals from a few minutes to a few hours), the secretion of hydrochloric acid is in excess of that which may combine with the albumin; and it therefore appears as **free acid.** The trace of lactic acid then disappears. As a result of the increased acidity, the digestion of starches, for the time being, stops. On the other hand, the dissolving of the albumins, their conversion into **peptones,** and the breaking up of the cell-wall of the fat-cells go rapidly on. The cellulose (or woody part) of vegetables and fruits is broken up, and the absorption of certain substances begins. All of these matters are greatly favored by the **muscular action of the stomach,** which by **peristalsis,** slow wave-like contractions (the cardia and the pylorus being closed), thoroughly mix the gastric contents and assist in their solution and absorption. The circulation of blood and lymph in the walls of the stomach is also much assisted by the action of the muscle-coat. As soon as the stomach contents have reached a certain degree of acidity, the time varying with the nature of the food, the pylorus relaxes and some of the partly digested food passes through it into the duodenum, or first part of the small intestine. Here are the openings of the ducts of the pancreas and liver, the secretions from which are poured into the intestine at intervals, owing to a reflex action set up by the acid food from the stomach. The bile, pancreatic juice and intestinal juice are alkaline, and soon mix with and **neutralize** the small quantity of food which the pylorus has allowed to pass. As soon as this has happened, the pylorus again relaxes and a fresh escape of food occurs from the stomach to the duodenum. The food thus is passed on in small quantities and is mixed thoroughly with the secretions of the liver pancreas and wall of the intestine by which digestion is completed. After the lapse of from four to seven hours the gastric digestion is practically completed, the organ having gradually emptied itself, and at length the pylorus relaxes sufficiently to allow the more insoluble remains to pass into the intestine.

Absorption of food from the stomach is less important than was formerly supposed. The alcohols, salts, certain extractive matters, and pure water may be, and to some extent usually are, absorbed directly from the stomach; but water in the presence of solid foods or blended with foods, as in soup, is apparently not absorbed by the walls of the stomach. A glassful of pure water is found to have left the stomach after a quarter or half of an hour, but when taken with food it only escapes with the latter in the ordinary course of digestion. It is probable that fluids taken by themselves pass along the lesser curvature (or upper border) of the stomach and soon pass out

Fig. 82. Internal organs of abdomen seen from in front, about half natural size. 1, Lower end of the breastbone. 2, Costal arch (edge of the ribs). 3, Left lobe of the liver. 4, Stomach. 5, Caul or great omentum. 6, Small intestine. 7, Part of the large intestine. 8, Peritoneal lining of the wall of the abdomen. 9 and 10, Two fibrous bands running up to the navel. 11, Caecum (beginning of the large intestine, to which the appendix is attached). 12, Large intestine or colon. 13, Its curve or bend below liver. 14, Gall bladder. 15, Right lobe of the liver. 16 and 18, Ligaments of the liver. 17, Parietal peritoneum (peritoneal lining of the wall of the abdomen).

at the pylorus. The work of the stomach, like that of the mouth, is to prepare the food for its final digestion and absorption in the intestine. The stomach has a very complex nerve-supply that governs its activity. It is therefore subject to derangements due to nervous excitation in various other parts of the organism; especially is it affected by the mental state.

The Small Intestine.—The intestine consists of two divisions, a small, or narrow part, and a large, or wide part. The small intestine is about twenty feet long in the adult, and is subdivided into three portions: the **duodenum**, extending from ten to twelve inches beyond

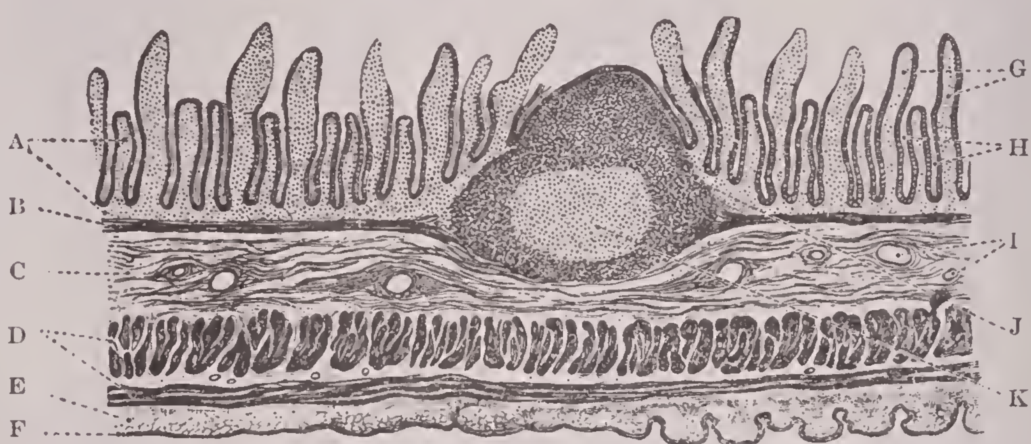


Fig. 83. Section through wall of small intestine. Magnified 40 times in thickness. A, Mucous membrane lining the inside. B, Thin muscle. C. Loose fibrous coat, which contains the large blood vessels. D, Muscle coat. E, Thin subserous coat. F, The peritoneal covering of the bowel. G, The villi; these increase immensely the extent of the surface of the interior of the small intestine and so aid the absorption of the digested food. H, The intestinal glands, small tubes in the mucous membrane. I, Blood vessels in submucous layer. J, Lymphoid nodule. K, Its germinal center.

the pylorus; the **jejunum**, which forms two-fifths; and the **ileum**, three-fifths of the remainder of the small intestine. These three parts are distinguished from one another by the character of the lining, or mucous membrane, which has a different appearance in each, but the change from one to another part is not abrupt, being, indeed, quite gradual. Like the stomach, the intestine is lined by a mucous membrane, with a single layer of columnar epithelium. It is thickly set with secreting glands, which are pocket-like indippings of the epithelium. It has a very vascular **submucosa** (the loose fibrous layer under the mucous, or mucous coat), and is rich in lymphatics. A **muscular coat** arranged in an inner circular and an outer longitudinal layer of fibers lies outside of the submucosa. Finally, like the stomach, it is clothed with a **serous membrane** continuous with the lining of the peritoneal cavity. This outer coat of the intestine is a part of the peritoneum. Between the two muscular layers lies a system of fine nerves (**Auerbach's plexus**), which preside over the movements of the intestine. In the submucous coats, extending from the stomach to the

anus, are situated the fibers of another plexus, or network of nerves, the nerves of secretion (**Meissner's plexus**). These nerves are provided with ganglion-cells, and it is probable that these are the centers that control the circulation, excretion and secretion of the intestine. The surface of the mucous membrane of the small intestine is enormously increased through the presence of the **valvulæ conniventes** and the villi. The former are numerous transverse folds projecting into the lumen (or interior) of the intestine; they interrupt and retard the current of the onward stream of the intestinal contents. Like other portions of the intestinal mucous membrane, they are covered

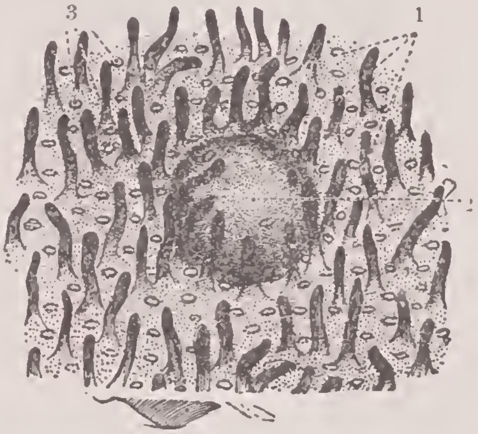


Fig. 84. A much enlarged surface view of the *mucous lining* of the *small intestine*, showing, 1, the *villi*, finger-like projections; 2, a *lymph nodule;* and 3, the mouths of the *intestinal glands*—little tubes which are sunken in the mucous lining.

with villi, which are small finger-like projections, one or two lines in length, so closely arranged that they cover the surface somewhat in the manner of fur. Between the villi are situated the mouths of the tubular depressions of the mucous membrane, called the intestinal glands, or **glands of Lieberkühn**; these extend throughout both the large and small intestines, increasing in size as they approach the anus. **Brunner's glands** are confined to the duodenum. They are placed in the submucosa and have excretory ducts, by which their secretion is carried into the lumen of the bowel; in structure and function they resemble the pyloric glands of the stomach. Lymphatic nodules occur in the wall of the intestine; they are most abundant in the lower portion of the ileum. These occur singly, or isolated, all along the alimentary canal; in the ileum, especially, they also form clusters, and are termed "agminate glands," or "Peyer's patches."

Accessory Digestive Organs.—The **liver** is situated on the right side of the body in a position closely corresponding to that occupied by the stomach on the left. It moves up and down with the diaphragm in respiration. Its secretion is the **bile** which passes temporarily into **the gall-bladder,** where it is stored until needed, but eventually is discharged through the common bile-duct into the duodenum. The bile

is forced into the duodenum by the contractions of the muscle-coat of the gall-bladder. This is caused to contract when the acid food from the stomach comes in contact with the orifice of the bile-duct in the wall of the duodenum. The bile is thus poured into the bowel **at intervals** only, and thus is mixed with all the food as it passes inter-

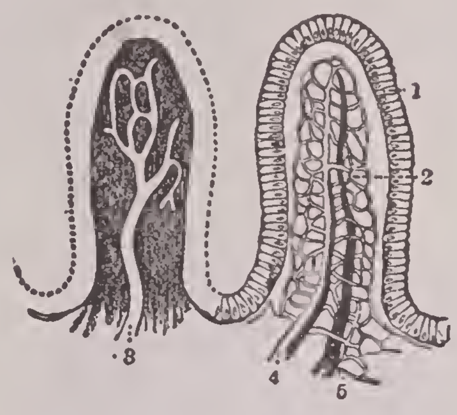


Fig. 85. Diagram of the villi of the lining of the intestine. 1, The epithelium covering the surface. 2, The blood vessels (4, artery ; 5, vein, joined by the network of capillaries). 3, Lymph-vessel or "lacteal."

mittently into the bowel. Near or beside the opening of the bile-duct is situated the outlet of the excretory duct of the **pancreas.** The latter organ, lying transversely across the abdomen, behind the stomach, is known as the "belly sweet-bread" in the animals that are used for food, and secretes a juice most important in the process of digestion. In some respects it resembles the saliva in that it converts starch into maltose; but it is far more complex, and possesses a second ferment that digests albumin, and a third that digests and emulsifies fats. The ferments in the pancreatic juice are termed **amylopsin,** which digests starch; **trypsin,** which digests especially proteids, such as lean meat, and **steapsin,** which digests fats. The pancreatic juice, the bile and the secretion of the glands of the intestine are alike **alkaline** in reaction. The **bile** may be regarded as an aid in intestinal digestion, although it also contains waste matter extracted by the liver from the blood.

Digestion in the Intestine.—Of the secretions of the wall of the small intestine, that coming from the duodenum is the most important in its action on food. The stomach-contents entering the intestine in the condition known as **chyme** are sharply **acid** in reaction, owing to free hydrochloric acid, and are semifluid or fluid in consistency. Chyme does not pass rapidly down the intestine, its course being delayed through the intervention of the intestinal folds and villi. It is soon rendered alkaline, however, by the action of the intestinal secretion, the bile, and the pancreatic juice. These various secretions at once take up the work of digestion. The albumin is still further converted into peptone, and the starches into maltose, and cane-sugar into glucose, while the fats are in part broken up into glycerin and

compounds known as "fatty acids"; in part it is broken up into minute droplets, or is said to be emulsified. **Absorption** of the products of digestion takes place into the veins and lacteals with which every villus, as well as other parts of the mucosa, is provided. Substances are absorbed from the intestinal contents through a process of selection, while certain harmful matters are discharged through the excretion of the glands. There is thus a more or less continuous interchange of fluids between the intestine and the blood-vessels. The veins from the intestine enter the branches of the portal vein, which carries the blood into the liver; the lymphatics, carrying most of the fat, empty into the thoracic duct, by which the **chyle**, or fat-laden lymph, is carried up through the thorax and poured into the blood in a vein on the left side of the neck. The blood from the stomach, spleen, pancreas and intestines, containing most of the digestion-products, passes to the liver, where the various substances are further modified and refined, and in part stored up for a time before passing on in the blood to the heart and thence to all parts of the body.

The Large Intestine.—The small intestine opens into the **cecum,** or beginning of the large intestine, in the right groin. The junction is guarded by the **ileocecal valve** which prevents the contents of the large bowel from passing back into the small bowel. The latter is about four to six feet in the adult, and is divided into three portions: the **cecum,** a short and relatively wide pouch, which has the **vermiform appendix** attached to it below and communicates with the colon, the principal part of the large intestine. The **colon** has an ascending, a transverse, and a descending portion. The last-named, located on the left side of the abdomen, loops around to form the **sigmoid flexure,** which in turn becomes the **rectum,** which terminates in the **anus.** It is the office of the large intestine to retain the waste matter and overflow from the small intestine, and to hold the feces until the liquid portions are sufficiently absorbed. The sigmoid flexure acts as a sort of valve and prevents the descent of the feces into the rectum until the act of evacuation occurs. The feces are then of proper consistency; through contraction of the walls of the colon the feces are discharged from the descending portion into the rectum, and then with the assistance of the abdominal muscles those of the rectum complete the process of evacuation; this is termed **defecation.** During the process, the hemorrhoidal veins (or veins of the lower part of the rectum) become more or less congested and engorged, especially if there is costiveness. It is well therefore to apply firm pressure to the anus with the toilet paper in order to empty the veins and avoid their permanent enlargement, giving rise to hemorrhoids or "piles."

INSTRUCTION NINE—*Alimentary*

The Teeth and Their Care

Importance of Teeth to Digestion.

Many Cases of Chronic Indigestion
Are Due to Imperfect Mastication.

Enormous Varieties of Germs Found in Diseased Teeth.

Subject Reference

For Teeth in Mastication, see Vol. 1, page 46.

Baby's Teeth, Vol. 1, pages 595-597.

For Diseases of Teeth, see Vol. 2, pages 394 to 398.

For Diseases of Gums and Jaws, see Vol. 2, pages 156-157.

For Prescription for Toothache, Vol. 2, page 617.

Defects and Deformities—Causes of Decay—Pyorrhoea—Care of Teeth—Mouth Wash—Brushing—Cleaning.

Perfectly Clean Teeth and a Clean Mouth Are the Best Defenders of the Stomach Against Digestive Disorders.

All Infection of the Stomach and Digestive Tract must Enter Through the Mouth.

NOTE:—Good, Sound, Clean Teeth in a Clean Healthy Mouth Are the Real Basis of Good Health, Comfort and a Long Life. The Importance of Frequent Visits to the Dentist cannot be overestimated.

Defects and Care of the Teeth.

Deformities.—Owing to heredity the teeth are sometimes too large for the length of the jaws, and, as a result, are forced out of line, and crowded against each other. Such defect may result from the frequent habit of **mouth-breathing**, a practice that is commonly due to obstruction of the nasal passages by hypertrophy of the adenoid tissue in the upper part of the throat into which the nose opens behind. The deformity in such cases consists in a narrowing of the hard palate or roof of the mouth and the dental arch, so that the line of the incisor teeth above projects too far beyond the line of the lower incisors, as illustrated in Fig. 85. The lower jaw may recede, and the symmetry of

© U. & U.

PREVENTIVE DENTISTRY FOR CHILDREN

Modern dentistry teaches the new way—prevention to preserve. Dental Training School for Women. Founder and director instructing student how to clean stains and remove tartar from children's teeth.

the face be disturbed as shown in Fig. 88A. Fig. 88B shows the same face with the lower jaw brought to its proper position. A deformity somewhat like this comes from "thumb-sucking." In this case the upper incisors slant forward and the lower incisors somewhat inward or backward, as seen in Fig. 87B. The habit of breathing through the

Fig. 87A. Deformity of the teeth due to "mouth-breathing." (The lips are drawn back to show the teeth.)

Fig. 87B. Teeth deformed by the bad habit of thumb-sucking.

mouth is usually associated with "thumb-sucking." It causes the accumulation of organic matter about the teeth and thus favors decay. People with weak teeth require much more care to prevent decay. These poor teeth are seen in rickety children, and in those with congenital syphilis, and sometimes in those who appear to be healthy. In

Fig. 88A. A receding chin due to mouth-breathing.

Fig. 88B. The same face with mouth closed.

congenital syphilis the permanent incisors are peg-shaped, notched, and sometimes so placed that their cutting edges meet. Often irregular eruption of the teeth is wrongly attributed to syphilis.

Causes of Decay of the Teeth.—The teeth of some individuals naturally decay easily. Even with intelligent care decay is a constant anxiety; on the other hand, in certain families, and particularly in cer-

tain races, the teeth are naturally strong and are often retained into old age—even when they receive no further protection than comes from vigorous use in the mastication of coarse and resisting foods. A like difference may be noted in the skin of people, and may be due to some peculiarity in nutrition. The **form of diet** has been thought by some to be a cause in caries of the teeth. The teeth that are least used in mastication are often the most delicate. Strong and resisting teeth seem to be natural to those who live upon coarse foods. Apparently the nerve-supply and blood-supply of the teeth is better in healthy individuals who use their teeth somewhat vigorously.

While caries seems to depend in part upon the **susceptibility** of the teeth of certain individuals, this has been denied, and apparently with some reason. A large number of extracted teeth were subjected to a great variety of tests, including exposure for varying periods to the action of chemicals and to the action of bacteria. When these teeth were subsequently examined by the most careful methods, there was seen to be practically no difference in the effects produced. Strong and weak teeth were affected alike, and it may be inferred that poor teeth do not differ materially in composition from those that are regarded as strong in their resistance to the influences that produce decay.

The old opinion that the teeth are injuriously affected through the action of certain acids formed in the stomach is also erroneous. More than one hundred varieties of micro-organisms have been found growing in the mouth or about the teeth. That caries is due to **lactic acid** produced by the growth of certain of these bacteria is possible. It is now generally accepted that the bacteria are in some way responsible for dental caries; but there is a doubt as to lactic or other acids playing any special part in it. About fifty varieties of germs are commonly present in diseased teeth, about one-fifth of the number being producers of lactic acid, but the strongest proportion of acid that is produced by the growth of these bacteria is 0.5 per cent. If teeth, good and poor alike, be subjected to a solution of lactic acid of the strength of 0.5 per cent. for four months, no carious action whatever occurs. Some of the organisms that are apparently destructive give rise to secretions alkaline rather than acid in reaction. It has been observed that some mouths in which caries is marked have a free secretion of saliva and a constant alkaline reaction. Much has yet to be learned about the matter; but it may be safely assumed that bacteria cause dental decay; that **natural resistance** of the teeth is of minor importance, and that the diet, so long

as it is sufficiently nutritious, has no influence whatever. When fragments of food, together with the secretions of the mouth, lodge between and around the teeth there is an opportunity for the growth and development of bacteria. Some idea of the number of these organisms may be had from what has been said above. Micro-organisms are concerned in the formation of the tartar so disfiguring to the teeth and injurious to the gums. But teeth are attacked and cavities are formed without the presence of tartar; all that seems necessary is for the organisms to find a lodgment in some place where they are removed from the action of the toothbrush and tooth-pick commonly used to dislodge them. Catarrhal inflammation about the margin of **the gums** leads to their recession and the exposure of the parts of the teeth unprotected by enamel. This catarrhal condition is due in large part to the action of bacteria, but is much favored by irritation from tobacco and acrid foods, also by the presence of tartar and by carelessness in the use of tooth-brushes, tooth-picks, and the hard foods.

A disease that occasionally affects the gums is **pyorrhœa alveolaris,** commonly called "Riggs' disease." Undoubtedly, as in the case of other infections, perfect systematic health is the best safeguard against infection of the gums, but that good general health can prevent the development of bacteria is not true. Injuries produced by the forcible introduction between the gum and tooth of hard foreign bodies, like seeds of berries, bits of bone, and bristles from the tooth-brush may give entrance to the germs of disease, causing this painful and disfiguring state of the teeth.

Care of the Teeth.—The preservation of the teeth depends on a few simple principles, namely: the prevention of overcrowding, the avoidance of chemical or mechanical injury to the teeth and gums, the careful and frequent cleansing of all the exposed surfaces of the teeth, and the use of such antiseptics as are harmless and will prevent the long stay of disease bacteria in the mouth. The easiest means of protection is the proper cleansing of the teeth. For this purpose the frequent **use of the tooth-brush** is indispensable. The ordinary bristle brush has been objected to on the grounds that it is too hard and is liable to injure the gums, especially when loose bristles are thrust into the soft parts around the teeth. Brushes of badger's hair, of felt, of rubber and of various other substitutes, have been recommended. Most of these, however, lack the essential resistance and elasticity so important for thorough removal of foreign matter. The bristle brush in which the bristles are not too close

together, thus admitting of their passage between the teeth, is the most practical appliance. Care should be taken not to let the bristles spread, and the brush should be discarded before it is soft or ragged from long use. The bristles should be medium stiff; soft, pliable bristles are almost useless. The brush should not be very broad, and should be bent in the direction of the tuft on the brush, so as to admit more easily reaching all the surfaces of the teeth. Begin at the

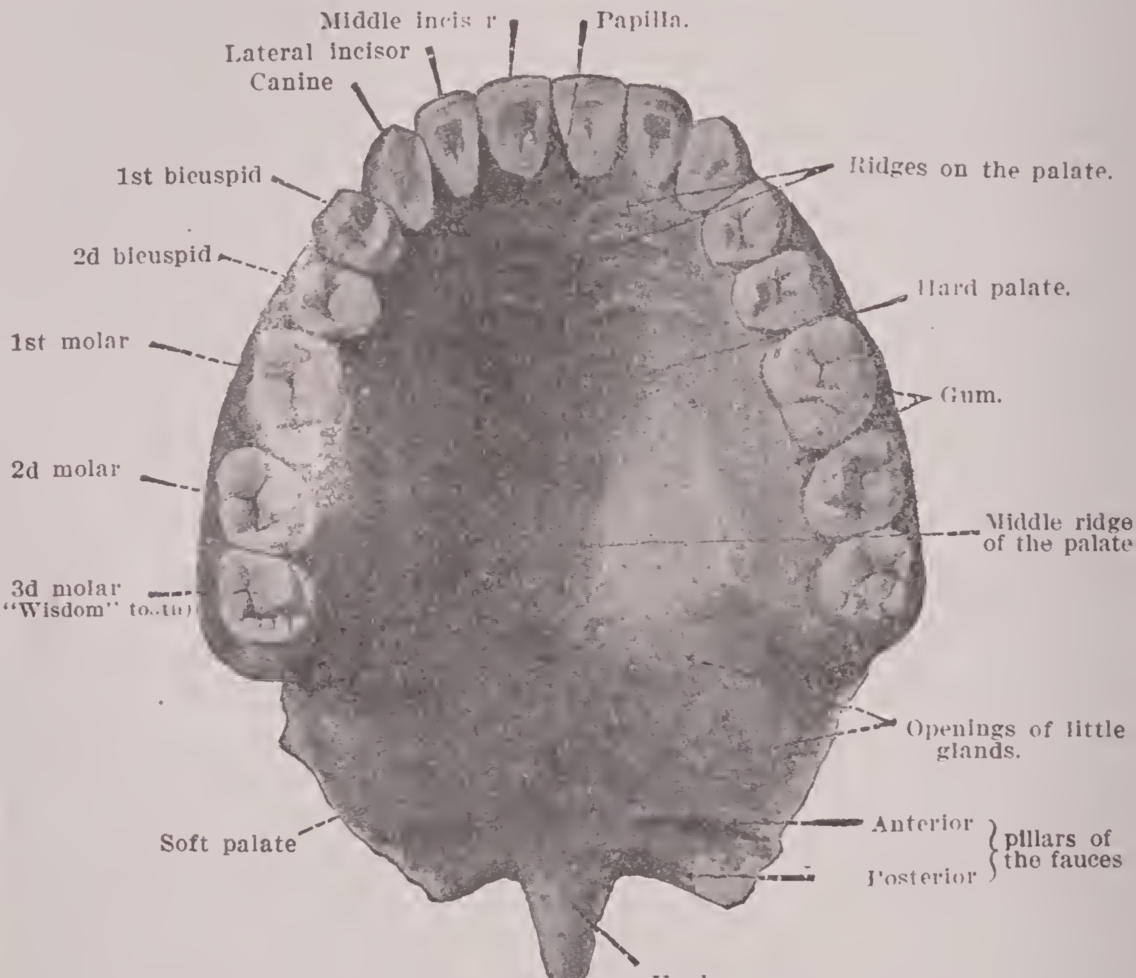


Fig. 89. The roof of the mouth and permanent upper teeth.

back teeth and clean them first. Brushing should be practiced after each meal and before going to bed, and once daily a **tooth-powder** sufficiently coarse to produce some grinding and polishing effect should be used. A powder that is very soft or very fine is of little value. Powdered chalk and orris root are common bases for tooth-powder. Some harmless antiseptic, such as borax, oil of wintergreen, or tincture of myrrh, should be combined with the powder to help destroy any bacteria that may be reached. Twice a week every side of the crowns of the teeth should be carefully gone over, and, with tooth-powder, carefully rubbed with a narrow chisel-shaped piece

of a wood that is hard and fine-grained, such as orange-wood, so as to smooth away all the roughness and inequalities. This gives a smooth polish to the teeth and renders subsequent cleansing by the tooth-brush a comparatively simple matter. If this rule were followed in the care of children's teeth, the work of the dentists would

Fig. 90. The permanent teeth.

be greatly lessened. Children's teeth are in just as much need of attention from the dentist as a grown person's. Of equal importance is the daily use of soft, silk twine, known as "dental floss." It should be drawn between the teeth firmly, but carefully, so as to remove food, etc., that cannot be reached in other ways. It is important not to cut or irritate the gums nor to loosen them from the teeth. A little experience enables one to accomplish the work deftly and quickly. If this be neglected the teeth cannot be said to have been thoroughly cleansed. A **tooth-pick** of quill, or of hard, smooth wood should be regularly used. Care must be taken not to press on or injure the gums with it. In addition to these methods, the mouth and teeth should be carefully rinsed every night with some harmless antiseptic solution. Some of the most harmless are powerful germicides, and only these should be employed, as others may do injury to the general health as well as to the teeth. Tincture of orris, rose-water, and alcohol in equal parts, flavored with a drop of oil of bitter almond, make a very agreeable **mouth-wash**, which may be rendered more antiseptic by adding 0.5 per cent. of formalin.

As it is not everyone who can devote as much time to the **care** of the teeth as is involved in the foregoing directions, it may be well to give here the best times to clean the teeth when this is done less often. If cleaned but **once** a day it should be at night **on retiring,** or better, just after the last meal, if nothing is eaten afterwards. If cleaned **twice** a day the best times are on **rising** and again on **going to bed.** If they are cleaned a **third** time it should be at **noon.**

A very good practice that strengthens the teeth and makes the gums healthy is to massage the gums frequently, the most suitable time being just after cleaning the teeth at night. It is done by rubbing the gums with the finger, using a fairly firm and slow, steady stroke **upward** or **downward towards the edge or margin of the gum.** The lips and cheeks may be used to assist the finger by pressing on it. This will also have the good effect of developing the muscles of the face.

The teeth should **never** be used to bite very hard things, such as nuts, nor should they take the place of scissors in cutting thread, as is so often done by women. This is sure to damage the enamel, chip and split it and expose the tooth to early decay.

The importance of the teeth in digestion is not always sufficiently recognized. Many cases of chronic indigestion are due to imperfect mastication, owing to faulty teeth. In all such cases it is of first importance to have decayed teeth filled, or if there are many missing teeth they should be replaced by artificial ones. Otherwise medication and dietary regulation may be of little avail. Only those teeth which have opponents (or others opposite them, against which they bite) are of any use. Every space due to loss of a tooth allows the food to escape proper mastication. People ordinarily are content to chew their food as little as possible, instead of **chewing it away to nothing,** i. e., until no solid pieces of appreciable size remain. The molars (i. e., "Millers") or back teeth are the important ones. Imperfectly chewed food does not digest as it should in the stomach, and so is not prepared for the important digestion that goes on in the stomach. Only what is digested or rendered liquid or soluble can be absorbed and become available as food to the tissues, hence individuals often starve, although they eat plenty of good food, owing to **indigestion,** i. e., "no digestion." It may be said that, given a meal, the only control we have over it is while it is in the mouth—all the stages after mastication and beginning of swallowing are beyond our control almost wholly—and should be beyond our ken.

Remorse, Worry
Impatience, Envy and Jealousy

Subject Reference

For Nutritive Principles and Problems of Diet, see Vol.2, pp.648-679.

For Nervous Diseases, see Vol. 2, pages 427-456.

Enemies to Appetite, Digestion and Sleep.

A Contented Mind and Joyful Nature Necessary to Perfect Nutrition.

Appetite.

We instinctively feel that loss of appetite or its unnatural perversion is a serious warning of degeneracy or decay. The lack of intelligent attention to the appropriateness of food exposes not only the digestive apparatus, but all the cells of the body to distress and not infrequently to disease. In this matter the problem is, first, how to train the appetite into natural and wholesome paths; and, second, how to live so that by means of proper physical, mental, and moral activity there may be successfully utilized the kind and quantity of food required in normal life, and that there may be successfully discharged the waste products that result. It is unsafe to trust to the guidance of the appetite alone, for the reason that this instinct was formed during a condition of existence very different from that which exists today. Nevertheless, **the appetite is a more reliable guide** than is mere speculation, and more trustworthy than a certain narrow scientific view which would select foods along the lines of nutritive values, ascertained only by chemical experiments. While there should not be neglect of knowledge as to the amount of energy that may be developed by one substance as compared with another, or the omission of some things that may be learned by rational deduction, it should never be forgotten that instinct is a guide that has been accumulating experience for unknown ages, and that **if life in other respects is normal** appetite is likely to lead very nearly in the right direction.

Effect of the Mind on Nutrition.—In the consideration of the effect of the mental and moral states upon the problems of nutrition there is much for thought. A contented mind, a willing disposition, and a joyous nature are as often a cause as a result of good digestion.

and may often be voluntarily cultivated and made habitual. It is a truth of such importance that no physician can wholly succeed in relieving derangements of digestion unless he takes this matter into consideration; in other words, remorse. worry, over-responsibility, petulance, envy, jealousy, and other undesirable mental states give rise to such disturbances that good health is not possible. This explains the fact that a change of scene, a long vacation, and new associations will sometimes improve the digestion and restore health generally when careful dieting and other measures have failed.

Effect of "Eye-strain" on Nutrition.—One of the most important sources of irritation of the nervous system is the continual use of the eyes in fine work, often in imperfect or wrongly directed light. In our modern system of education, in which children from the kindergarten upward are required to use the eyes closely upon small objects, in association with the concentration of the mind, this evil is found in an aggravated form. As this sacrifice seems demanded by the requirements of education and culture, the nervous system has to undergo the strain as best it may. It has long been recognized that headache and various kinds of nervousness result from eye-strain, but that the appetite and digestion also suffer are facts that are too little recognized. Nutrition is first to show the result of nerve-strain, no matter from what cause, and, as a rule, some peculiarity of the digestion gives the earliest hint of the trouble. For instance, there may develop a distaste for certain articles of food; the appetite may become capricious or perverted. Again, a disturbance in movement will arise, and the stomach may contract in a spasmodic, tremulous, or irregular way, while the individual is conscious of disagreeable and sometimes alarming sensations, with eructations of gas or fluid from the stomach. Or the gastric juice may be secreted irregularly, and in many instances a long chain of dyspeptic symptoms appears without any real disease of the stomach, but merely from a disturbance of the nervous system, due to improper habits of life. In a sense the stomach is acting as an advisor; but if we are wise it may often be regarded as a kind mentor. This very common experience may be avoided sometimes by removing the strain on the nervous system, and by strengthening it by exercise, bathing, recreation, and more hours of sleep and repose. Eye-strain may be lessened or removed by wearing spectacles that are made accurately and adjusted precisely; or by attending to the direction in which light enters the room, or perhaps by prohibiting the use of books printed with small or bad type. Observance of these precautions may make it unneces-

sary for the individual to give special attention to his diet; but it is the usual custom for the stomach to be considered at first the source of trouble. As the disagreeable digestive experiences are attributed to the stomach, the fault is commonly supposed to lie in the character of the food, and wiseacres take the responsibility of advising the withdrawal of sugar, fats, or meats, and the abundant use of oatmeal, grits, and beef-tea, a dietary most likely to undermine resisting power and in the end to do infinite harm. For similar relief resort is sometimes had to a milk diet or to abstinence from food, because it is found that the stomach is more comfortable when it has little to do. But this erroneous course will ultimately fail; it is always wiser, when possible, to remove the cause of the difficulty. When it is impracticable to remove the source of worry it is then necessary to modify the diet, and it is a compromise of this sort that unfortunately we must sometimes make.

Regulation of Size and Time of Meals.—To adapt the diet to a tired nervous system and an irritable stomach the most hearty meal should be taken at a time when it is possible for one to have the greatest composure of body and mind, and much should not be demanded of the digestive organs when unusual taxation of the nervous system has been experienced. It is not wise in such cases to take a hearty breakfast before activity of the organs is sufficiently aroused; nor is it well to have the chief meal at midday, when the energy is likely to be taxed by work or study. It is better to wait until late in the afternoon, when, after a little rest, the chief meal should be taken—slowly, composedly, and cheerfully. After this a few hours should be spent in quiet enjoyment before going to bed.

This arrangement will seem an absurdity to those who insist that a late dinner is in itself the sure forerunner of a bad night. This is usually true only when the midday meal has been too hearty. A delicate digestion may be overtaxed by too frequent meals in a given time. It is better to require from the digestive organs a moderate display of energy in the morning, and very slight at midday; but at evening, when the tissues demand food and when the physiologic appetite has appeared, the digestive system will perform its greatest work when unincumbered by worries or by muscular and mental activities that draw the blood away from the organs of digestion and call for energy in too many ways at one time. This principle applies to children as well as to adults. Of course, this need not be taken too literally in cases of sturdy and hungry little folks, who are always

ready to eat. The rule should be adhered to in proportion to the delicacy of the child; the food for a child should be of a kind quickly disposed of, and therefore a greater frequency of meals is usually permissible. In fact, an invariable law as to the **frequency** of meals for persons of any age cannot be laid down, but **regularity** should be insisted upon. Convention too often decides in the matter, and the hours for eating are appointed without reasonable regard to physiologic requirements. Nevertheless, the rule given above is applicable to the majority of mankind. It does not mean that the average man has a weak digestion, but it means that he is overtaxed in a general way, and that if he does not give intelligent attention to the character and hours of his meals, then he is likely to develop, first, consciousness of the act of digestion, and, later, distress during the process.

Food and Dietetics.

"Food is that which, when taken into the body, builds up its tissues (that is, causes growth) and keeps them in repair, or which is consumed in the body to yield energy in the form of heat to keep it warm and create strength for its work."

A man of average weight and activity takes about 325 grams (11½ ounces) of dry solid matter and from 1,500 to 2,000 grams (50 to 65 ounces or about 2½ to 3½ pints) of water by the mouth, and about 550 grams (19½ ounces) of oxygen through the lungs each day. The solid matter taken as food should be composed of proteids and nitrogenous organic matter, of fats, and of carbohydrates. These are termed "proximate principles." A constant diet containing excessive amounts of any of these three classes of foods, with or without deficiency of one or both of the other constituents, will in time be injurious to health. In order to obtain all the elementary constituents of food required for nutrition we resort to a **mixed diet.** A deficiency in one kind of elementary food for a brief period is readily equalized by variation in the diet on different days of the week. Custom has fairly well brought about a selection of a dietary which generally meets the requirements of the body.

Nutritive Values and Cost of Foods.—The following table shows the relative proportions of the elementary food-constituents in some of the more common food-substances with the quantity that can be purchased for twenty-five cents, as well as the amount of energy (in the form of heat) that is contained in it.

Table A.—Nutritive Values and Cost of Foods at Comparative Prices (Not War Prices).

Raw Food Materials.	Prices per ½ kg. (1 lb.)	Twenty-five cents will buy: Total food materials.	Nutrients: Total.	Protein.	Fats.	Carbo-hydrat's	Energy or fuel value.
		Grams[1]	Grams.	Grams.	Grams.	Grams.	Calories[2]
Beef, sirloin	25	500	155	75	80	.....	970
Beef, round	16	780	235	140	95	.....	1,335
Beef, neck	8	1,565	465	245	220	.....	2,755
Mutton, leg	20	625	190	95	95	.....	1,170
Ham, smoked	16	780	385	115	270	.....	2,705
Salt pork	10	1,250	1,045	10	1,035	.....	8,775
Codfish, fresh	10	1,250	135	.....	.....	.....	510
Codfish, dried salt	8	1,565	255	250	5	.....	985
Mackerel, salt	10	1,250	370	185	185	.....	2,275
Oysters, 25 cents a quart	12.5	1,000	120	65	15	40	520
Eggs, 25 cents a dozen	14.7	850	190	105	85	.....	1,115
Milk, 8 cents a quart	4	3,125	385	115	125	145	2,030
Cheese, whole milk	15	835	545	235	295	15	3,455
Cheese, skimmed milk	10	1,250	675	480	85	110	2,910
Butter, 25 cents a pound	25	500	430	5	425	.....	3,615
Sugar, 5 cents a pound	5	2,500	2,445	.....	.....	2,445	9,100
Wheat flour	2.5	5,000	4,350	550	55	3,745	16,450
Wheat bread	5	2,500	1,670	220	40	1,410	6,400
Oatmeal	5	2,500	2,260	370	180	1,710	9,225
Beans	5	2,500	2,110	580	50	1,480	8,075
Potatoes, 60 cents a bushel	1	12,500	2,135	225	10	1,900	8,000

Table B.—Analyses of Cereals and Leguminosæ.

I. COMPOSITION OF THE CEREALS.

Cereal. Free from all moisture.	No. of analyses.	Nitrogenous substances.	Fat.	Nitrogen-free extractives[3]	Cellulose	Ash.	Nitrogen.
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Wheat	1,358	13.89	2.20	79.75	2.19	1.97	2.22
Rye, winter	173	12.48	1.77	81.04	1.78	2.06	2.00
Barley	766	11.24	1.93	77.24	4.95	2.42	1.79
Oats	377	12.13	4.99	66.41	10.58	3.29	1.94
Corn, flint	80	11.74	4.78	79.20	1.67	1.40	1.88
Rice	10	7.00	2.00	84.76	4.00	1.16	1.12

II. COMPOSITION OF THE LEGUMINOSAE.

Leguminous Seed. Completely Dried.	No. of analyses.	Nitrogenous substances.	Fat.	Nitrogen-free extractives.	Cellulose.	Ash.	Nitrogen
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Beans	63	29.26	1.68	55.86	8.06	3.13	4.68
Peas	72	26.39	1.39	61.21	5.68	2.68	4.30

[1]To convert grams to ounces see the Table of Comparison of Metric with English Measures.

[2]A *calorie* is the amount of heat required to raise the temperature of a gram of water through one degree Centigrade—or it is very nearly the amount of heat that will raise 8½ grains of water through one degree Fahrenheit.

[3]Such as starch.

Table B shows the composition of the more common food cereal and leguminous grains, based upon a large number of analyses. This table shows the elementary food-constituents of these food-materials, expressed as nitrogenous substances, fat, and nitrogen-free extractives. The relative amounts are such that excessive quantities of refuse matter (such as cellulose) and of carbohydrates must be taken to obtain the required amounts of proteids. This is the chief source of dissatisfaction with a true **vegetarian diet**—that is, a diet entirely of vegetable foods.

Cooking.—The modes of preparation are of as great hygienic importance as the composition of foods. Cooking has two principal effects on food: it **softens** the food and renders it easier of mastication and digestion; and it also makes it **more palatable.** In addition to these alterations cooking also destroys all bacteria that may be lodged in or upon the food, and thus frees it from danger to health.

The mode of cooking has a marked influence upon the digestibility of **meats.** The common ways of preparing meats are roasting, broiling, boiling, and frying. **Roasted** and **broiled** meats retain a large proportion of their juices, and are, therefore, both more palatable and more nutritious. **Boiling** extracts the juices from the meat and consequently alters their nutritive qualities as well as their palatability. It makes the meat more tender and digestible, however, if properly done; it also gives opportunity to flavor the meat by the addition of savory vegetables and spices. **Frying** in fats and oils is a good method when the fat is just hot enough.

The purity of food-materials is as important as their quality and quantity. Foods may be **adulterated** in several different ways, as by the **extraction** of some of the most valuable ingredients and the **substitution** of inferior or useless substances, and by the addition of various **preservatives** intended to prevent or retard decomposition.

Milk may be adulterated by the removal of cream (with the addition of coloring-matters to mask the abstraction of cream), the addition of water, or the addition of preservatives, such as formaldehyd or borax. **Preserved fruits** are commonly adulterated by the addition of glucose. **Jellies** are frequently found on the market that are composed entirely of artificial materials, such as glucose, coloring-matters, etc. Both jams and jellies are commonly made of turnips and apples, with flavoring substances and coloring-matters (always artificial or imitative) and seeds added, with sometimes a small amount of the real fruit, such as strawberries or raspberries. **Baking-powders** are adulterated by the substitution of alum for more expensive ingre-

dients, the alum being not only useless, but harmful, yet taking the place of necessary ingredients. **Butter** is adulterated by the addition or complete substitution of other fats of vegetable and animal origin. **Olive oil** is adulterated by the substitution of the cheap cotton-seed oil.

Food may contain disease germs or parasites of infectious diseases. **Milk** from tuberculous cows may contain tubercle bacilli; or it may contain pus-producing organisms when there is catarrh or inflammation of the udder. It may also serve as the carrier of other disease-producing bacteria by the accidental entrance into it of such organisms as cause diphtheria, typhoid fever, dysentery, or cholera. These organisms usually gain access to milk by the addition to it of polluted water or by the rinsing and washing of the milk-containers with such polluted water. Milk may be the carrier of scarlet fever when this disease exists in the family of the milkman or dairyman, or in the family of any of his customers, if the bottles are not properly and thoroughly sterilized (by boiling in water containing baking soda is the best way). Butter may carry disease in much the same way as milk.

Meat may contain the organisms of tuberculosis as well as the ova and larvæ of animal parasites, as trichina, cysticercus, etc. For these reasons meat **should never be eaten in the raw state** nor without proper cooking. An exception may be made in the case of the raw meat feeding of consumptives with carefully selected and examined beef. **Green vegetables** may be contaminated with the germs of disease when they are raised in ground fertilized with night-soil, or when washed in infected water. **Oysters** are now recognized as a frequent source of typhoid fever, on account of having been freshened in sewage-polluted streams. It is not generally known that the oyster is put in fresh water streams or rivers to make it plumper or "fatter."

Inspection of Foods.—The dangers from infected meat and milk and from adulterated foods in general can be guarded against only by the most rigid inspection by sanitary officials. These are conditions which the individual cannot control, but in which he can and should co-operate with the proper authorities.

The inspection of meats should include not only the routine slaughter-house inspection, but also continual and rigid inspection of all meat exposed for sale in markets and shops. A great deal of the danger from the use of diseased and putrid meat can be avoided by such inspection.

Regulation of the Diet.—What should be the character of the food

taken? The answer must at first be as general as the question; the digestion may be taxed either in the quantity or the quality of food, and in direct ratio to the resisting power and vital energy of the individual. Climate and occupation must also be considered. A stalwart wood-chopper requires in the winter large meals, rich in fats and carbohydrates, which produce a relatively large amount of heat, together with albumins that more directly nourish the muscles and nerves. With such a worker, so long as the food is nourishing enough, great attention need not be paid to its variety, nor even to its digestibility. For instance, some woodsmen crave a rather indigestible form of pastry because it "stays by" and does not too quickly leave the stomach empty. For such persons the hastily prepared oatmeal-pudding is suitable, because it is slow to digest.

For sedentary and indolent persons the supply of food should be small and digestible. For the sedentary brain-worker the amount should be increased in proportion to his mental activity, and it should be easily digestible and very nutritious. In a cold climate large amounts of fats are required, while in hot climates the carbohydrates and fruits are demanded by natural inclination.

For the business or professional man, or for the student, **breakfast** may consist of one or two soft-boiled eggs or an omelet, a piece of bacon or fish, a roll or some toast, and one cup of coffee, or a substitute for it if coffee does not agree. Oatmeal porridge is apt to be unsuitable, because it is rarely well mixed with saliva, but is hurriedly bolted, swallowing being made easy by the covering of cream. The same may be said of other "cereals," except those that are partially dextrinized by previous cooking in the process of manufacture. Early in the morning, while dressing, at least a glassful of pure water, neither iced nor hot, should be taken slowly.

If breakfast is at eight, **luncheon** should be at one. Milk is excellent for this meal. It disagrees with some, but usually because other foods are taken with it. Milk is not a drink, but a **food.** It is best taken alone, but generally agrees better if a certain amount of starchy food is taken at the same time, although the latter should be carefully masticated and insalivated, and should neither be saturated with milk nor washed down by it. Milk should be drunk slowly and bread or biscuit eaten slowly—to take advantage of the action of the saliva in converting the starch of the bread into maltose, while the milk, being divided and mixed with the bread or biscuit, is more readily digested. For those who dislike milk, or with whom it does not agree, luncheon may consist of broth or light soup, bread and butter,

a few oysters, sweet-bread or stewed lobster, and perhaps a little farinaceous pudding, like corn-starch, thoroughly prepared rice, or tapioca. All these dishes may be varied by their equivalents. Fruit may form a part, or fruit may be taken before breakfast, and rarely after dinner. Dinner should be taken at six or thereabouts. It should be served slowly and in courses. The conventional arrangement of the courses at dinner is a desirable one, and is apparently the result of the experience of ages. The preliminary course of a good soup that is not too rich, followed by fish, then a joint or roast, with one or two vegetables, a small salad, bread and some simple dessert constitute a typical dinner, and should be sufficient in quantity to make up for the somewhat scanty meals that preceded it.

The digestion is usually taxed in proportion to the variety of the foods taken; therefore, when the stomach does not bear an extended meal well, food should be limited—first in variety, and second in quantity. The precise amount to be taken during all these meals must depend upon individual requirements. "People habitually eat too much," says Osler; but there is a large class of nervous people who eat regularly, but rarely take a sufficient amount of really nourishing foods to repair the wasting of the tissues.

The following table shows **the amount of food required by a healthy adult in 24 hours:**

	In laborious occupation.	At rest.
Nitrogenous substances—*e. g.* flesh	6.0 to 7.0 oz. avoir.	2.5 oz. avoir.
Fats	3.5 to 4.5 oz. avoir.	1.0 oz. avoir.
Carbohydrates	16.0 to 18.0 oz. avoir.	12.0 oz. avoir.
Salts	1.2 to 1.5 oz. avoir.	0.5 oz. avoir.
	26.7 to 31.0 oz. avoir.	16.0 oz. avoir.

To this should be added from fifty to eighty ounces of fluid, i. e., from two and one-half to four pints.

The arrangement of meals above described is for the average brain-worker. In some cases a heartier breakfast will be necessary. and with others a certain amount of lassitude and depression may occur late in the afternoon, when only a light luncheon has been taken. In the latter case, relief may be had by allowing a cup of tea and a cracker at four o'clock. Drunk at this time, tea rarely disturbs sleep, and it is not likely to blunt the appetite for dinner. Some individuals have naturally a rapid digestion, and hunger is experienced toward bedtime. In such an event it is best that a little simple food be taken. Only those who have vigorous constitutions can indulge

at night in "lobster à la Newburgh," rarebit, and the various other savory and rich preparations that the use of the chafing-dish has made popular. This is not an argument against eating before going to bed, but merely an instance of the imprudence of taking food unsuitable in kind or at a wrong time. It must not be supposed that the dietary should not be varied, for there is no doubt that **monotony** in daily living is bad hygiene.

Proper Preparation and Cooking of Food.—Many articles of food that are considered unwholesome are so merely because they are badly prepared. Too much cannot be said in favor of scientific cooking, and that most important article of diet, **bread,** is most often open to criticism. Really good, well-baked, sweet, crisp, "nutty" bread is regularly found only in few households. Indeed, many people probably do not know what "good bread" means. Much of the opposition to potatoes is unjust, and is due to ignorance in their preparation or in the prejudice of certain writers. A great variety of green vegetables that are not only palatable, but fairly nutritious, and which are wholesome because they contain acids, salts, and extractive matters required by the body, are easily enough digested when they are well prepared. Aside from their nutritive value, they are useful in making more bulky the contents of the alimentary canal, thus favoring the activity of the stomach and intestines, by which constipation is avoided and a healthy state of the mucous lining of the stomach and bowels is favored.

Fruits.—It is not necessary to urge Americans to eat fruit; they too often err in taking too much. It is not uncommon in this country for people to eat fruit at any time during the day or evening. The benefits from eating fruits are undoubted; the digestive organs are acted on somewhat as by the green vegetables, but fruits have other advantages from the acids contained, and also because they appeal to the esthetic sense. The eating of fruit before breakfast is unobjectionable in most instances. Fruit may also properly form a part of the luncheon and dessert, but it should not be eaten between meals. The harm in eating fruit lies in its excessive quantity or wrong time, or in eating that which is unsound or unripe. Sometimes also in not rejecting the indigestible skin or seeds, which irritate the stomach and may cause acute indigestion. All fruits should be well crushed in eating, either by the teeth or before taking into the mouth.

Coffee, tea, and cocoa have their place in normal diet; and while they occasionally are the source of much disturbance, this is generally due to over-indulgence in them. As a rule, **coffee and tea are taken**

in excess, and, on the whole, do more harm than good. They should be carefully and properly made. See directions given in the section on Foods. The **temperate** use of these substances that have come to be almost necessities of the human race is very rarely injurious, or, indeed, not positively beneficial. After the morning bath a small cup of coffee, gently stimulating the circulation and the motor function of the alimentary tract, generally accomplishes good. The use of tea in the afternoon has been pointed out. Both coffee and tea, particularly the latter, antagonize the action of the saliva upon starch, and, therefore, taken in excess retard digestion. There will be little trouble if bread is sufficiently well masticated and if no drink be taken while solids are in the mouth. The saliva passing with the food into the stomach stimulates the secretion of that organ, and therefore indirectly assists in the digestion of the albumins. This is another reason why careful habits in eating should be made sure early in life.

Sugar contains much energy, and is a useful article of diet; but if taken early in the meal, it lessens the appetite and hinders digestion.

The action of condiments, such as mustard, pepper, spices, etc., is quite varied. Most of them appeal to the sense of taste, and act as local stimulants to the salivary glands and to the stomach. The high seasoning of food not only depresses the sense of taste for simpler foods, but also is harmful in irritating the gastric and intestinal mucous membranes and the liver.

Fats and oils should always be included in every dietary. Even in warm climates they have always formed an important item in the foods that are selected by choice. It is difficult to explain the fact that they are disliked by some children, although the health may be failing for the want of them. In such cases evident improvement follows when fats are added to the diet. Fats should not be taken before or early in the meal, for the reason that they protect the mucous membrane of the stomach from its normal stimulation by the other foods, and thus tend to lessen the secretion and motion of that organ. If fats are taken late in the meal or following it, they do not disturb digestion unless fermentation occurs. Intestinal digestion of fats seems to consist of **the splitting up of the fat cells**, a process of emulsification that is for the most part accomplished by the action of the pancreatic juice, assisted by the secretions of the liver and duodenum. Part of the fats are broken up into fatty acids and glycerine and as such are absorbed and then reformed. Quantities of minute particles of fat are to be found in the lacteals during intestinal digestion, and

they subsequently appear in the blood, from which the tissue-cells readily appropriate them. The assimilation of fats is a simpler process than that attending the albuminoids, starches, and sugars; and to suppose that fats are unwholesome is erroneous. When incorporated with starches and sugar, however, in the form of pastries, etc., they are likely to disturb digestion. This is because the starch-cells are protected by a coating of the fats, from the action of the saliva in the mouth and stomach and from the action of the pancreatic juice in the intestine; and for the further reason that the fats are often superheated in cooking, forming indigestible and irritating fatty acids.

The salts compose an important part of the diet. They occur as various combinations of sodium, potassium, lime, magnesium and ammonium. Of these, the most important is sodium chlorid, common salt, or table salt, which makes up 5.5 parts in every 1,000 parts of the plasma of the blood, and occurs everywhere in the body except in the enamel of the teeth. A sufficient amount is not derived from unseasoned foods, and therefore the use of salt as a condiment or seasoning is universal. Hydrochloric acid is derived from it and forms a most important constituent of the gastric juice; it seems reasonable, therefore, that salt should be taken in connection with the albuminoids, with which the gastric juice has most to do in digestion. Salts aid in the solution of some substances in the process of digestion. Salt may be taken in excess when salted meats form the chief food, or when an unnatural habit of eating salt is acquired. But if one is deprived of salt there is not only a disturbance in nutrition, but also an unfavorable alteration in the gastric juice.

The Drinking of Water.—The question of drinking water is one that requires some consideration. As has been stated, about eighty ounces (two quarts) of liquid should be taken daily. This includes what is taken in combination with solid foods. Most people leading sedentary lives take too little water, and also err in taking it for the most part when eating. A certain amount of water should always form a part of every meal, and particularly is it necessary in those who have very active digestion. It assists the escape from the stomach of those substances made soluble by the action of the gastric juice and the churning action of the stomach and will sometimes make digestion comfortable when, without water, it would be attended with distress. But while water is to be taken with meals, it should be observed that the food ought not to be washed down. Such a practice not only interferes with starch digestion, but also enables

the individual to swallow morsels of food altogether too large and resisting for the stomach to manage comfortably. The proper time for taking the bulk of the fluid is between meals, particularly early in the morning and late at night. It is a fact well known to physicians that especially women drink too little water; the habit probably results from the inconvenience attending the taking of the proper amount, since the kidneys are then more active and the urinary bladder must be evacuated oftener; but this very activity of the kidneys ensures a more thorough cleansing of the whole body and consequent better health and greater comfort. While a person may be saved some embarrassment by this kind of denial, positive harm usually results from the continuance of the practice. The American habit of drinking **ice water** has been much censured. It is unnatural, and in some instances harm is directly due to it. In many no injurious effect appears to follow its use. That those who enjoy cold drinks are likely to take sufficient water must be said in its favor. It is for many people an excellent thing to take a mouthful of cold water half an hour or so before a meal, or especially on rising. It tones up the stomach much the same as a cold bath does the skin.

The practice of drinking **hot water** in the belief that it prevents or cures dyspepsia is of doubtful value. Some people seem to benefit by it. The sipping is a good heart stimulant and may be the cause of the good effect from hot water drinking. Very hot water has to be taken in such small sizes that it is cooled down enough by the time it reaches the stomach and cannot do any damage there. Doubtless hot water has its place, but it is to be recommended rather as a remedy than as a daily beverage.

Alcoholic Drinks.—In general it may be said that alcohol is unnecessary; and, aside from the viciousness of inebriety, or drunkenness, it sometimes produces disturbances of digestion. This is particularly true in those unaccustomed to its use, and is truer of beer and wines than of the distilled liquors, except when these are used too freely. The continued use of alcohol in any form disturbs the nervous system so that nausea, loss of appetite, and other disturbances arise; and if the practice is still further continued congestion and catarrh of the stomach and irritation of the liver ensue. These facts are, of course, universally accepted; but the question is how much may digestion be harmed by the taking of a **small amount** of wine or spirit as a part of an occasional feast or as a regular accompaniment of dinner. While it is a fact that wines and beers rich in extractive matters interfere with gastric digestion, it must be admitted that unpleasant effects are

not usually experienced in temperate people, particularly when they are active in mind and body. Certain individuals are always the worse **from even the temperate use** of alcohol, tobacco, tea, or coffee; and such individuals should also abandon chocolate and cocoa. These persons are exceptional, however, and in the case of the ordinary man, leading an active life, a moderate amount of alcohol may be taken without harm. Unfortunately, moderation does not satisfy, and deplorable results arise that are apparently due to the gradually increasing use of alcohol.

Other Stimulants.—Certain authors hold that stimulants of all kinds should be avoided, putting the ban of exclusion upon condiments, spices, hot foods, ice, and carbonated drinks, as well as upon tea, coffee, cocoa, and alcohol. But this is not logical, for the digestive apparatus is stimulated on the one hand and depressed on the other by equally potent factors that cannot be excluded; for instance, by constantly occurring emotional states as well as by recreation, exertion, and fatigue. The latter group will be considered as merely physiologic influences, and therefore not open to criticism; but this conclusion is not altogether true. Certain depressing **mental states** interfere with digestion to such an extent that the appetite is lost, nausea induced, the gastric secretion interrupted, and the movements of the stomach and intestine arrested, or irregular and spasmodic movements of these are induced which lead to the upward discharge of gas from the stomach and perhaps regurgitation or vomiting of the undigested food; or there may be developed severe contraction of the gastric muscles, causing severe pain. The same causes very frequently induce gastric distress and occasional neuralgia. On the other hand, tempting displays, agreeable zests, and appetizing odors, are stimulants that as often lead to excess in eating as they do to increased activity in digestion. A curious phenomenon is the overdistention of the stomach and intestine with gas which apparently does not arise from fermentation, but appears to be **abnormally secreted** in the stomach and bowels. Under such conditions a gentle stimulant will enable the digestive organs to regain their normal state, after which a small amount of fluid food may be easily managed. These are the cases for a cup of tea or coffee, or a posset of aromatic herbs, and those who have not moral scruples against its use—and also those who have—may be quickly relieved by a thimbleful of brandy.

Eating After Bathing.—A similar state of depression of the di-

gestive organs may result from too prolonged a bath; and the popular opinion that it is unsafe to eat after bathing is well founded, because, in some people, digestion is interrupted by bathing. This does not apply to all alike, but is true often enough to give warrant to the popular belief and practice of not bathing soon after or before a meal.

Eating After Exercise.—Physical exertion is more likely than bathing to disturb digestion. Its effect upon the digestion is similar to that produced by mental fatigue. Singularly enough, this has not been universally recognized; and it is common for people who are physically exhausted from tennis-playing, bicycling, and other violent exercises to take a hearty meal without first resting. Most people know that vigorous exercise directly after a meal is harmful; but they do not realize the mistake of eating heartily when too tired. These truths apply more especially to those who are untrained and unaccustomed to physical strain; but athletes have found that it is not wise to eat heartily when about to engage in great exertion. During a period in which the pedestrian Weston walked a total of 317 miles in five days, he consumed on an average about 83 grammes of proteids daily. Yet in the diet of an ordinary farmer or mechanic in this country about 100 grammes of proteids are taken daily or during 24 hours. Of course, other forms of food besides proteids are taken, and much energy is derived from the fats and carbohydrates. As a rule, a well-trained man who is carrying on for a prolonged period an unusual amount of work is able to eat and digest more food than the ordinary man. The disproportion between the food taken and the energy expended may be approximately ascertained by noting the change in the weight of the body. Under great strain more proteid is required than under conditions of normal exercises; but when the strain is to be short and severe it is wise to restrict the diet, lest there should follow rebellion in the stomach.

Influence of Carriage and Dress on Digestion.—Abnormal conditions of the liver are for the most part due to disorders of the stomach and intestines, and in cases in which there is derangement of the functions of the bowel it is usually safe to conclude that the liver is also out of condition. One of the most common causes of sluggishness of the liver, as well as of disturbances of the intestines and other portions of the digestive apparatus, is **faulty carriage of the body** and relaxation of the abdominal muscles, lessening of the abdominal type of respiration, and consequent loss of diaphragmatic

motion.[1] The whole abdominal organs are thereby deprived of the natural massage which they should continually have when respiration is properly carried on. All these conditions are made very much worse, and some of them are directly caused, by the improper dress almost universal with women, and to some extent with children. A woman, said to dress loosely, with her corset removed measured twenty-seven inches around the waist, but as ordinarily dressed she

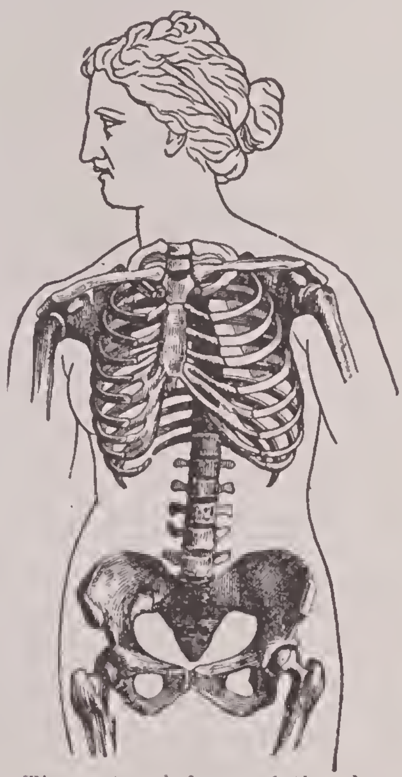


Fig. 91. The natural form of the thorax (or chest).

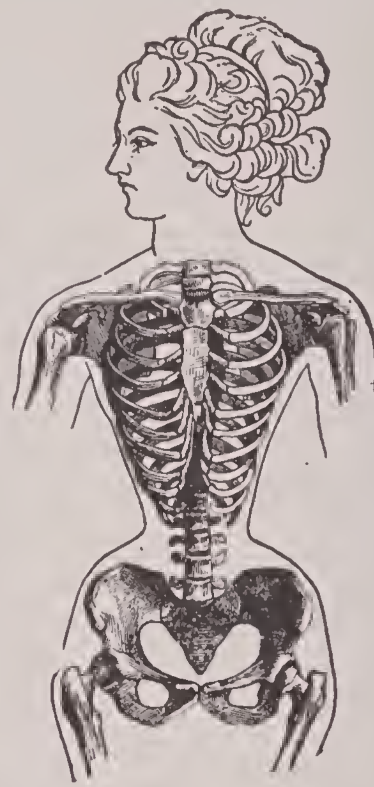


Fig. 92. The thorax deformed by tight lacing. The heart, lungs and abdominal organs have not proper room for their development and healthy working.

measured twenty-one inches around the waist **outside the garments.**

For the stomach, liver and intestines to do their work properly it is necessary that they should be allowed free and properly related movements. Such movements are impossible in the large majority of women. The defects are so common, and the deformities of the body necessarily associated with them begin so early in life, that they are overlooked, and are thought to be natural and beautiful by

[1]In inspiration the space in the thorax is enlarged partly by the ribs rising (costal type of respiration), partly by the diaphragm or flow of the thorax descending and pushing the abdominal viscera down and forward (abdominal type of respiration). In respiration the ribs fall and the diaphragm and abdominal organs rise. This movement of the internal organs favors the circulation of blood or other contents within them.

the mass of womankind. A certain amount of pressure within the abdomen is necessary if the organs of that region are to be held in their proper places and proper relations. This is possible only when

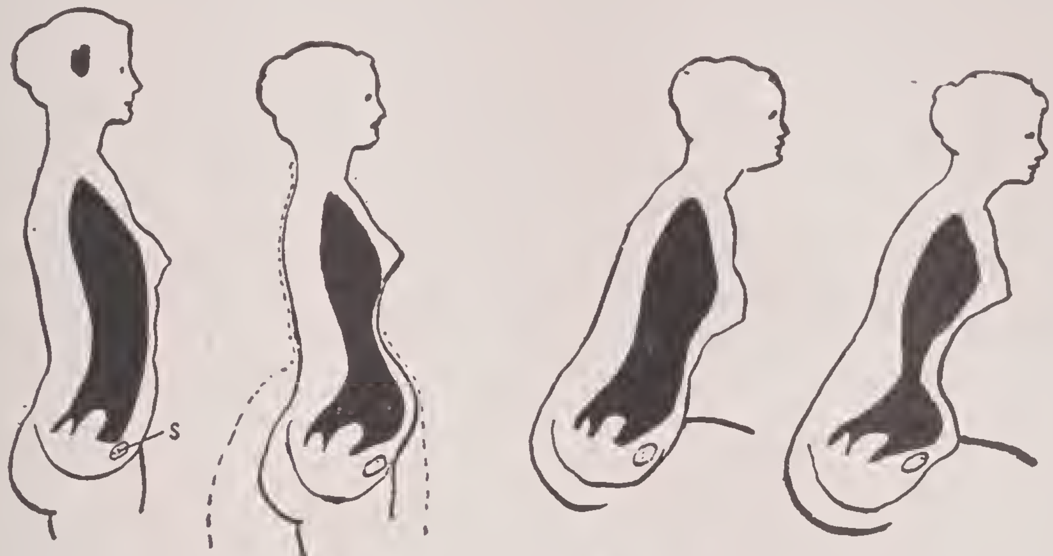


Fig. 93. The effect of constricting the waist. The black represents the body cavity (space in the thorax, abdomen and pelvis, lodging the internal organs). I and III, normal; waist free. II and IV, abnormal; waist constricted, or "tight laced." I and II, standing. S is the symphysis pubis. In II the dotted line represents the dress. III and IV, sitting. Note that the abdomen is made prominent by the tight lacing. This means also that the abdominal organs are forced downward!

the body is erect in sitting and standing, when the chest is habitually kept raised to its normal position, and when the abdominal muscles are strong, and are not allowed to relax, pouch out, and allow the

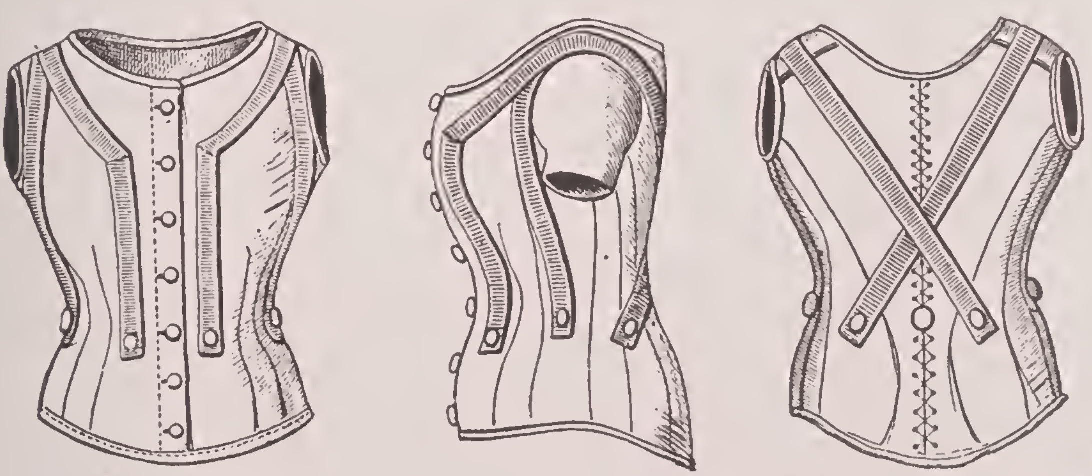


Fig. 94. A substitute for the corset. The straps and buttons for the skirt and petticoats take the weight of these off the waist and puts it where it should be—on the shoulder—thus avoiding ill-effects on the internal organs.

descent of the organs. This attitude should be urged during childhood, and mothers should be instructed in the proper method of dressing their children, so that the chest may have the freest motion

without hindrance from the clothing. All garments should be suspended from the shoulders, to avoid the downward displacement of the stomach, intestines, kidneys, liver, etc., which is very apt to occur when the weight of the clothing is borne at the waist. Practically all women stand in wrong attitudes, a fact of which they are apparently ignorant. Others would not remain ignorant of the fact, but for the concealment by women's dress. That this is no exaggeration, every physician who has given the subject careful study will readily agree; but the fact is not generally known that more than half of all civilized women, in all classes of life, have developed the condition known as **enteroptosis.** This means that the stomach, intestines, very often the kidneys, and sometimes the liver, are pushed downward and remain permanently out of their proper position. Such, however, is the case; and this condition more than any other cause is responsible for the constipation, backache, debility, biliousness, early loss of complexion, headache, and that long list of ailments of which so many women in all civilized countries are victims. Individuals with vigorous constitutions and strong nervous systems, and who keep the body in a healthy tone by leading out-of-door lives, and who avoid the common habits of worry and petulance, may live with moderate comfort, even though suffering from the enteroptosis made necessary and permanent by the methods of dress. But most women lack these sturdy qualities, and, therefore, suffer more or less from the symptoms described. Furthermore, this downward dislocation of the abdominal organs causes displacements and derangements of the pelvic organs, and the genito-urinary diseases so common in women are a natural result. In young children the intestines have not yet assumed that position which is normal in adult life, and in some this lack of development, combined with the incorrect dress, causes a constant difficulty in evacuation of the bowels. By a slow process, and in the absence of interference, these matters in time right themselves; but not infrequently the child is denied out-of-door sports, adequate physical training, and proper methods of dress, and the large intestine never assumes its proper place.

Constipation and Diarrhea.—Downward displacement of the bowels not only causes constipation, but it also favors catarrh of the intestinal lining, leads to intestinal indigestion, and occasionally produces diarrhea, and sometimes pain and the discharge of mucus with the feces. There are, of course, other causes besides displacement that commonly give rise to constipation and other unhealthy conditions of the intestines, important among which are diet and habit.

Influence of the Nature of the Food.—The cellulose, or fibrous part, of fruits and vegetables exercises a wholesome influence upon the intestinal functions, increasing the bulk of the contents and stimulating the secretions of the intestinal glands and the contraction of the intestinal muscles. Formerly, when the use of coarser foods was more common than at present, when flour and meal were less carefully bolted in milling, constipation was less common. For these reasons it is often advised that those who suffer from constipation should confine themselves to coarse and bulky foods. It is true that such a diet is beneficial to one class of people, but it is harmful to another. When the mucous membrane of the intestine is less than normally irritable, when the unstriped muscle-tissue is so indolent that it fails to contract from the stimulus of soft and semifluid contents, then both the secretion and the motion of the part are so diminished that there is slowing of the intestinal stream, and an evacuation does not occur until there is a considerable accumulation in the colon. Under such conditions the bowel is usually successful in emptying itself unassisted, but only irregularly and after improper delay. Such stagnation of the intestinal stream is injurious to the intestine and to the whole body. The intestine suffers because of the undisturbed stay of micro-organisms, the dulling of the normal irritability of the motor and secretory nerves, and the weakening of the intestinal muscle; the whole body suffers because of the absorption from the intestine of certain poisonous substances that are much more likely to be formed when the intestine is inactive. These poisons, finding their way, first, to the liver and then to the general circulation, develop those symptoms known as **biliousness.** This term has come to have a broad meaning, which, indeed, is necessary, as the expressions of this form of auto-intoxication (or self-poisoning) are varied. A coarse diet may be very serviceable in relieving the condition described above. But there is another and nearly as large a class in which the mucous membrane and muscle of the intestine are **too irritable.** This results sometimes from a low grade of inflammation affecting the lining of the intestine; sometimes it is due to over-excitability of the nerves of the part. Under such circumstances the ordinary bland, unstimulating diet results in intestinal contents that excite the irritable bowel to proper activity; but if the food is coarser and contains much vegetable fibers or husks of grain it causes so much mechanical irritation that the intestine contracts, spasmodically and prevents the normal onward movement of the feces. These agencies may cause over-secretion and over-motion, and a diarrhea

follows, usually to be succeeded by constipation, and it in turn by diarrhea. The physical condition accompanying either one of these states may not be unlike that accompanying the other; and whatever course of living most tends to regularity is equally useful in the prevention of diarrhea and constipation. There is no one diet that is suitable to all cases of constipation. For the ordinary individual it is a mistake to restrict the diet to over-refined and highly nutritious foods; nor should the other extreme be followed. A correct blending of coarse and fine foods, with the proper admixture of meats, vegetables, fruits, fats, starches, and sugars, is the diet most likely to agree with the intestine as well as with the stomach. Everyone must observe what foods agree and what do not, and be, in a measure, "a law unto themselves" in this at least.

The influence of habit is equally important in evacuating the bowels, as it is in the matter of eating. The habit of having a regular daily movement after the morning meal should be patiently and assiduously cultivated. Irregularity in defecation, usually the result of postponement because of inconvenience, is one of the surest means of inducing constipation, hemorrhoids, and other unnatural states of the intestine. Few realize that the digestive apparatus is under a sensitive nervous control, and does not tolerate improper treatment without most certain resentment. While infrequency in defecation is evidently harmful, over-frequency is also to be condemned. For the colon to contract naturally and be successfully emptied it should have a certain amount of contents of a sufficient consistency. These stimulate a regular and progressive contraction of the bowel-wall and a successful result. In children the amount of effort put forth, the time required for defecation, and the form, quantity, and character of the evacuation should be carefully observed, and any departure from the normal, if continued, should be attended to by revising the diet or other possible conditions. If necessary a doctor should be consulted. It is a matter of life-long misery or happiness to the child and, trivial though it may seem, it should not be neglected. The dejections are normally more frequent in the young than in the adult. Yet even in children the habit of going to stool several times during the day should be discouraged. There is a certain rhythm necessary in most processes occurring in the body, and this is so true of the digestive tract that disregard of the impulse for natural defecation always results in irregularity and more or less suffering.

FOODS ARRANGED IN ORDER OF DIGESTIBILITY.

Food.	How prepared.	Time Remaining in Stomach.
Pigs feet, soused	Boiled	1 hour 0 minutes.
Tripe	Boiled	1 " 0 "
Eggs, whipped	Raw	1 " 30 "
Salmon Trout, fresh fish	Boiled	1 " 30 "
Venison	Broiled	1 " 30 "
Brains	Boiled	1 " 45 "
Liver	Broiled	2 " 0 "
Codfish, dried	Boiled	2 " 6 "
Eggs	Roasted	2 " 15 "
Turkey	Boiled	2 " 25 "
Gelatine	Boiled	2 " 30 "
Goose	Roasted	2 " 30 "
Pig, sucking	Roasted	2 " 30 "
Lamb	Broiled	2 " 30 "
Chicken	Fricasseed	2 " 45 "
Beef	Boiled	2 " 0 "
"	Roasted	3 " 0 "
Mutton	Boiled	3 " 0 "
"	Roasted	3 " 15 "
Oysters	Stewed	3 " 30 "
Cheese	Raw	3 " 30 "
Eggs	Hard boiled	3 " 30 "
"	Fried	3 " 30 "
Beef	Fried	4 " 0 "
Fowls	Boiled	4 " 0 "
"	Roasted	4 " 0 "
Ducks	Roasted	4 " 0 "
Pork	Roasted	5 " 15 "
Rice	Boiled	1 " 0 "
Apples, sweet and mellow	Raw	1 " 30 "
Sago	Boiled	1 " 45 "
Tapioca	Boiled	2 " 0 "
Barley	Boiled	2 " 0 "
Apples, sour and mellow	Raw	2 " 0 "
Cabbage, with vinegar	Raw	2 " 0 "
Beans	Boiled	2 " 30 "
Sponge cake	Baked	2 " 30 "
Parsnips	Boiled	2 " 30 "
Potatoes	Roasted	2 " 30 "
"	Baked	2 " 33 "
Apple dumpling	Boiled	3 " 0 "
Indian corn cake	Baked	3 " 0 "
Indian corn bread	Baked	3 " 15 "
Carrot	Boiled	3 " 15 "
Wheaten bread	Baked	3 " 30 "
Potatoes	Boiled	3 " 30 "
Turnips	Boiled	3 " 30 "
Beets	Boiled	3 " 45 "
Cabbage	Boiled	4 " 0 "

Serious Advice to Teachers and Parents

Subject Reference

For Effect of Remorse and Worry on Appetite and Digestion, see Vol. 1, page 127.

For Nervous Diseases, see Vol. 2, pages 427-456.

How the Nervous System Governs Our Mental and Physical Well-Being.

The Mother is the Child's Most Intimate Influence. School Children Affected from Early Age.

NERVOUS PROSTRATION — NEURASTHENIA.

Nervous System—General Principles.

The general construction and mechanism of the nervous system are analogous to **a great telegraphic system.** By the nerves, which run in all directions like a lot of telegraph wires, the most distant parts of the body are brought into inter-communication, first, with the spinal cord, and then, if need be, with the central station, the brain, where messages are received and may enter, and others are sent out through the nerve fibers, composing the great cables (so to speak) of the brain and cord, to be switched off at various levels to their proper destinations.

If all tissues in the body, besides the nervous, could be completely removed, the remaining part or nervous system would form a complete skeleton of every portion of the body. In other words, the nervous system pervades the whole body and gives unity to it. It is upon the perfect integrity of this delicate and intricate organization that the healthy activity of every other tissue in the body depends. Our physical as well as mental well-being are, therefore, wholly under its control. The brain and spinal cord are dependent for their own vitality upon a blood supply which comes to them through arteries, which, for the most part, are "end-arteries," or arteries which have no communication with one another, which means almost inevitable death to any part when its arteries break down or become closed up.

There are certain so-called **"stigmata** (or blemishes) **of degeneration."** Among these are a high-arched palate, misshapen ears or skull, hare lip, cleft palate, etc., which are supposed to indicate that individuals in whom any of these occur are apt to be mentally and morally deficient. However, it is probable that education in its broadest sense, including all the effects of the influences which affect

the mind and character of the individual, from his birth to mature manhood, and environment are much more important factors in determining one's mental and moral status. "We come into the world, each one a being of limited capacity, but in other respects free to become what circumstances make us, and responsible, to the extent of our capacity, for our lot. We bring no ticket-of-leave which stamps us drunkards or maniacs on probation, but we do bear, in the histories of our ancestors, a certificate that hints by what efforts and by what avoidances we can make ourselves reasonable successes in our respective lines. There is no original sin, and not even, as it seems to me, original propensity, but only original capacity and original limitation, and even limitation is only another name for latent capacity."[1]

The problem of the hygiene of the brain and nervous system is a far-reaching one. The stability and integrity of the mental and nervous organization may be affected from a very early period, even the conception in which the life of the individual takes its beginning. In many unfortunate cases one or both parents are, at this time, on account of alcoholism or other vice, for the time being, in a condition of morbid alteration, the baneful influence of which may be profound and enduring. But proper care of the mind and body at this time is only the beginning of parental responsibility. Throughout pregnancy especially, and all through the period of lactation, every effort should be made to protect the mother from all possible causes of nervous wear and tear, chief of which are worry and anxiety. The mother is the child's most intimate influence and upon her well-being depends very largely the health of the child. Proper food and clothing, an abundance of sleep, and life in the open air are necessary to the fullest health of the body and nervous system of the child. "A healthy mind in a healthy body—**mens sana in corpore sano," will** always be true. It really means: "If you don't take right care of your body, your mind will not be healthy."

The advent of the school-going age brings many serious problems, and as it is often at this time that the laws of mental and nervous hygiene are first violated and most regrettable results are brought about, the whole subject is deserving of treatment at some length.

Are American children sent to school at too early an age and compelled to do more mental labor than is consistent with the

[1] The Shattuck lecture—"Not the Disease only, but also the Man." By James J. Putnam, M. D., of Boston.

healthy growth of their physical and mental organization? With regard to this it may be stated at the outset that, so far as children under twelve years of age are concerned, the danger of overwork of the mind has been unjustly emphasized, for, with very few exceptions, the natural inattention and playfulness of children are their safeguard in so far as a real danger exists. Of far greater importance, as far as nervous and mental welfare is concerned, is the matter of sunlight and pure air in the school-room, and of seats and desks which will not deform the pliant spines and chest-walls of children, but will favor the circulation to the important nervous centers upon which the strain of study naturally comes. Parents and educators should turn their serious attention to such matters as these—to the whole subject of **hygiene, in fact**—for with such absolute necessities unattended to, the present warfare which is being waged over the teaching of matters of tenth-rate importance, notably the food-value of alcohol, is quite out of order, to say the least. Impure air we **know** to be a poison and we should see to it that the children are not exposed to it. A distorted spine is easily caused—and is easily prevented—in a growing child, but is vastly more easily acquired than corrected.

Some children, however, are exceptions to this probable immunity to the dangers of mental overwork. Such may be termed the dangerously precocious, and for them the overstimulating methods of modern school-instruction are fraught with great dangers. As a rule these children are frail in body and of a decidedly tuberculous tendency, the activity of their physical powers seeming to be in the inverse ratio to that of their mental. What such children really need is repression rather than stimulation of their mental faculties. For them the ideal training is one of the body and of the vegetative functions especially, and this they can get only by all possible out-of-doors life.

After the age of twelve brain overwork really becomes worthy of serious consideration, for it is then that what may be termed the "fancy-work" of education commences. Children are launched upon the variegated curricula of high-school and academy, and are subjected to mental gymnastics sufficiently difficult to tax the powers of an adult. What then must be the result to children who are approaching that very important physical and mental crisis, puberty?

Puberty is one of the most important agencies in regard to mental and nervous health. Many extreme views as to its proper treatment have been advanced. Without doubt in both sexes (but

especially in boys) the psychical effect of puberty often outweighs the physical; the real awakening of the "ego," of the condition of self-consciousness, the proper trend of which means so much for the health of the nervous system, may be a marked accompaniment. Nervous and mental aberrations are not uncommon at this period, but these are certainly not all due to brain overwork. This may occur in rare instances. The root of the evil lies largely in the mawkish sentimentality and artificial modesty of a large percentage of parents, preventing them from explaining to their children the mental as well as physical significance of the changes which they undergo at this period. The result often is, in the case of the girl, that the establishment of the menses comes as a mental shock which may prove the "last straw" of a nervous break-down, for which her "studies" have already prepared her. In the boy the reaction is different and frequently far more disastrous. Finding himself in the possession of a newly-awakened instinct, he is often led into habits which may result in nothing less than mental and nervous ruin.

This subject should receive the serious attention of every parent and teacher. An undue importance attached to the direct physical results has given rise to wrong treatment of the subject in much of the medical writing on this topic. Such teaching is dangerous. It imbues the naturally self-conscious youth with the fear of irreparable, self-inflicted bodily injury. A vicious cycle is set up in which the youth imagines he has physical ills and this results in actual suffering which in time augments the imagined symptoms. The primary factor is the implantation of the morbid fear, and unless this is quickly gotten rid of the complete nervous undoing of its victim is effected sooner or later by misguided medical or lay advisors, or by the criminal insinuations of designing quacks, by whose villainous publications the country is continually flooded, to the shame in many instances of newspapers that should be above such traffic. The correct teaching of practical morality is the key to the problem. The responsibility of the entire matter rests primarily with parents and teachers; but judging by the prosperity of the very lowest and worst sort of charlatans, and by the large number of persons who, under the scourge of the most pitiable mental anguish, seek advice of reputable physicians in regard to this subject, it would seem that this responsibility is shirked very often most culpably. Here it is all-important for the young mind to be properly fully and congenially occupied. From infancy on, too, parents should

cultivate the fullest confidence and mental sympathy of their children, and so be in the best position to guide and inform them in everything.

Nervous Prostration—Neurasthenia.

General Remarks.—When overwork of **the brain** causes nervous break-down in children there is usually a hereditary weakness as a predisposing cause, and a disregard of the principal laws of personal hygiene, as an existing cause of the condition. This is true also in the case of college men and women. The nervous breakdown thus brought about does not differ in any important characteristics from that due to other causes, and it will be well to discuss all the factors which may be active in the production of "American nervousness" or "neurasthenia."

The average American has no more **inherent** liability to undue exhaustion of his nervous powers than has the inhabitant of any other country. And yet disregard of the ordinary laws of hygiene adds so many victims yearly to the evil consequences of an abused nervous system that the question of prevention is of vital importance.

"Neurasthenia" is a condition of **pathologic fatigue** of the entire nervous system, together with a coexistent condition of **morbid nervous irritability.** It probably has its basis in definite pathological conditions, but of these little is known as regards the human subject. Fatigue causes definite changes in the nerve-cells, as has been shown in the case of birds, bees, etc., by Hodges.

Causation.—The causation of this condition is one of the deepest and most subtle subjects with which the physician has to deal. It embraces not only factors of heredity but also of education—using this term in its broadest sense. These two, **heredity** and **education,** are the most important predisposing agents in the causation of nervous exhaustion. A strong third cause is **occupation.** The prolific inventor, the broker on the stock exchange, and others whose business involves much emotional unrest, form the majority in the now great army of neurasthenics. School-teaching also seems to be a prolific source of this unfortunate state. **Social position** is often erroneously included as predisposing by writers both lay and medical. That neurasthenia is by no means confined to the wealthy is evident from the fact that about 40 per cent of the cases in the nervous department of the Boston City Hospital are of neurasthenia,

and the same probably holds true for the hospitals of other large cities.

The Jewish race furnishes the largest quota of nervous sufferers. Americans are not, contrary to popular opinion, peculiarly liable to nervous disorder, but get the name of it from the circumstance of the inclusion, as American, of all sorts of immigrants.

Neurasthenia most commonly develops between the second and fifth decades (**i. e.**, between 20 and 50 years of age), although it occurs not infrequently at both earlier and later ages.

In the description of the anatomy of the nervous system, it has been shown that the brain, spinal cord and nerves are made up of **neurones** or special cells with very long thread-like processes or extensions, and also shorter processes by which the individual neurones are linked together into chains forming paths for nervous impulses. These connecting processes are supplied with bud-like side projections and which can be extended or retracted, thereby being put into communication or shut off from one another. When the neurones are thus linked together they can act and nervous functions, as for instance consciousness, can go on. It is probable that the nerve-cell rests and is repaired only when shut off from its fellows by retraction of its little projections, but this power of retraction and rest may be lost or so much diminished that the nerve-cells are unable to renew their reserve of energy.

In this state of unrest, the nerve-energy becomes much depleted, hence the fatigue-symptoms. The excess of irritability, too, is explained by the constant "connected" condition of the nerve-cells. When one part of the nervous system is active, the other parts are more or less inactive, or their inactivity (and resting) is favored. Hence **"a change of work is as good as a rest."**

The immediate or "exciting" causes of neurasthenia stand in the following order: overwork, whether physical or mental (but especially the latter, and more particularly when it is worried about), and prolonged morbid emotional states, such as worry, anxiety, vexation, and grief.

Symptoms.—Since neurasthenia is a state not only of fatigue but of undue excitability or irritability, it presents symptoms both of degraded or insufficient function of the organs and also of excess of reaction at times. The sufferer presents symptoms of disturbed digestion, circulation, secretion, and sexual functions. Nor are these all. The strict domain of the nervous system itself also contributes its quota to the morbid symptoms, and the motor sensory and intel-

lectual functions are more or less disordered, weakness and incapability of sustained muscular effort, as is easily shown by the diminishing power of the hand-grasp, and by the tremulous character of even the slightest muscular effort.

The sensory disturbances are of the most varied kinds. There are, in some cases, actual pains in various parts of the extremities and trunk; in other cases areas of heat or of cold are complained of. Headaches, which are sometimes referred to the top of the head, and sometimes to the base of the skull, are very frquently a symptom and are very distressing. They may seem to the sufferer to have been continuously present for months or even for years. There is present often also a feeling as if the head were too heavy for the shoulders, or as if it were being constantly pulled back by the neck muscles, or as if the head were enclosed in a tight helmet. Often the spine is tender throughout its entire length, at times extremely tender. Tender spots also occur in various places on the body, especially about the breasts and over the stomach. Patients often have numbness and pain extending from the elbow along the border of the forearm into the ring and little fingers. This is most common on awakening in the morning. Frequently a dull, dragging ache takes the place of lively pain in the extremities, and in addition to the aching there may be odd sensations, "as though the blood were bubbling in the veins," or "as though the heart were beating all over the arms or legs."

The disturbances of the special senses of sight, hearing, etc., are often very marked. Among the earliest is a blurring of vision on using the eyes for some considerable time. The patient may be totally unable to do any work, such as sewing, reading or writing, which requires steady, fixed vision for any length of time. The disorders of the ear usually take the form of sounds in the ears, such as ringing, buzzing, whistling, singing, roaring, for which there is no external cause. Hearing itself is seldom seriously impaired. Disorders of smell are rare, but those of taste are frequent, "nothing tastes right," or there is a bitter or a salty taste in the mouth, without the taking of food. The mental disturbances are very striking and often cause the greatest mental anguish. Finding himself incapable of giving close attention for any length of time without great physical discomfort, the patient soon begins to fear that he is losing his mind, and this engenders a habit of introspection which may have very bad consequences. A host of other fears are soon added to that of insanity. The capacity for initiation, for doing things, be-

comes so limited that the patient's friends often have to help him in the most commonplace undertakings. He becomes emotional and cannot bear to read of accidents, murders, or sudden deaths from apoplexy or heart disease. His sleep is not peaceful, and he may awake feeling more tired in the morning than when he went to bed. Sudden spasmodic jerkings of his legs, or a feeling as of falling may occur when he attempts to sleep. As a rule, nervous sufferers usually think they get much less sleep than they actually do.

The indigestion is varied, but most frequently consists in an inability to digest starchy food. Everything eaten rests like a lump of lead in the stomach, and the gas from the fermentation going on in the stomach often distends the stomach so that it interferes so much with the heart's action that it becomes a source of anxiety to the patient, who imagines that he has heart-disease. Sometimes there is faintness an hour or so after meals. The movements of the bowels are irregular, but constipation is more common than diarrhea. It is often the spastic variety of constipation. Other heart symptoms may occur independently and give rise to much worry. The pulse is often heard in the ear by the patient himself, especially when his head is lying on the pillow, or the pulse is felt whenever two parts of the body are brought together. This is due to the relaxed state of the blood vessels. The vasomotor apparatus of the blood vessels is frequently so irritable that sudden flushings and pallors often occur. The patient often has profuse and annoying sweatings, either by day or by night, which may be general, or confined to the hands, or even to one surface of an extremity. Extreme dryness of the mouth is present in certain instances, in others salivation. Frequent voiding of the urine is common. Disturbances in the sexual sphere may be prominent, less frequently so in women.

Fortunately, not all these symptoms occur at once, and many may not appear in a given case; but a large number, if at all prolonged, develop nearly the whole series, especially if introspection plays a prominent part, and these are most among the educated classes. With such a people a little medical knowledge is a dangerous thing. They are morbidly alert for the new symptoms of which they are informed, and which, owing to the great power of mind over matter, are not long in being felt.

Pathology.—Little is known of the change in the nervous system in neurasthenia. In animals the changes produced by extreme fatigue have been carefully studied. Their nervous tissues have been brought into the condition of exhaustion either by electric stimula-

tion or by prolonged normal exercise. In these experiments the results were always the same. The nerve-cells were altered in size and shape, and in their constituent elements; there was a general shrinkage of the whole cell, and the cell-nucleus became irregular in outline. The chemical reaction of the cell-protoplasm was also altered. A further discovery of interest was that cells recovered quickly after brief electric stimulation, but only very slowly after five hours' stimulation, twenty-four hours' rest scarcely sufficing to bring the cell back to normal.

While we are not warranted in saying that the same pathology holds absolutely good for nervous exhaustion in the human species, similar changes probably do occur in this latter condition.

Prognosis.—The duration of nervous exhaustion depends upon so many and so varied conditions that the outcome of each case must be decided on its own merits. Recovery up to a certain degree occurs as the rule; at times it may be complete; but this takes place usually only after a long and discouraging struggle, with many relapses. Patients will often lose in a very short time what they have been many weeks in gaining. Very, very few come out of the conflict unscathed. Many recover sufficiently to deal with the ordinary duties and trials of life, but are never quite capable of successfully weathering its real storms.

Prevention.—The subject of treatment proper of the fully developed condition does not come within our scope, but we are here desirous of showing what hygienic laws will prevent ourselves, or those confided to our care, from drifting upon the shoals of nervous and mental depletion.

The mental as well as the physical sides of the body are involved, and therefore the **moral** as well as the physical aspects of the problem must be taken into account. The hygienic principles that must be observed by no means apply solely to the prevention of that single disorder of nervous and mental health which is known as neurasthenia. On the contrary, they apply equally to a very large number of equally preventable diseases of the brain and nervous system.

The nervous and mental health of a nation is in direct relation to its moral health. The greatest enemies of the nervous system are syphilis, alcohol, and worry. Many of the paralytics who are dragging their painful way along to a premature grave, and hundreds of other people who, in the very prime of life, meet with shipwreck of their intellectual faculties, are simply the victims of their own excessive appetites and unrestrained licentiousness.

The Curative Effect of Silence.—The **effect of noise** on those who are ill has long been recognized. Of course, from "noise" we exclude those rhythmical sounds that we call music, which are decidedly restful to most tired persons. It is the unmusical sound that wearies. Tan bark is spread over city pavements in front of the dwellings of the critically ill, and patients are placed in quiet rooms to get rid of the injurious effect of noise. Hospitals are not always erected in quiet neighborhoods as they should be, but usually there is apparent some effort to protect the inmates from noises. When life hangs by a thread, absolute silence in and about the sick room often is enjoined. Physicians have generally and consistently tried to limit noises in the vicinity of the ill. Occasionally a voice is raised in protest against the many and seemingly unnecessary and steadily increasing noises that assail the ears of city dwellers. Excessive constant noises are injurious to health, and even those who are not ill have a right to be protected from the detrimental clatter of city life.

While physicians have approved and practiced all these measures when applicable, and so far as circumstances permitted, it is to the neurologists who systematized the "rest cure" that we owe some appreciation of the real curative value of silence in the treatment of neurasthenia and "brain-fag." Withal, however, little thought seems to have been given to the possibility of the existence of an "eartire," analogous to "eyestrain" in its reflex manifestations. This conclusion, however, seems to follow naturally from the observations and methods of those experienced in the treatment of neurasthenia. Uniformly "quiet" is insisted on for these cases, and the worn-out broker, as well as the weary "society" leader, is quickly restored to health by the quiet of an ocean voyage or of a remote mountain, forest, or lake resort. The **rest, change** and **air** have in such cases heretofore been uppermost in the mind, but there is much ground for the belief that the relative **absence of noise** has been a potent factor in producing the good results. Of course, the evil results of eyestrain, being due to abnormalities of function in a much more complex organ, are perhaps more marked or more readily proved than are those due to "eartire." It has been a long and arduous task, however, to convince the world of the manifold ills resulting from unrelieved eyestrain, but physicians have always recognized some of the benefits of quiet. For certain troublesome neurasthenic cases, particularly in women, this suggests a practical measure. Women are often utterly exhausted by a day of noisy shopping or

nearly as noisy social duty. They seek relief in many ways. The best thing for them is one or two or three hours spent in the quietest available spot each day until relieved. Even conversation and the sounds of their own voices should be avoided; there are many who wear out their nerves talking and listening to others talk. It takes a lot of nervous energy either to talk or to listen.

Many trying "nervous" cases are relieved by the "silence cure," just as so many others have been entirely relieved by spectacles for the correction of errors of refraction. Many educated persons and some famous ones long since found out for themselves the physical pleasure and nerve restfulness of periods of quiet.

The Abuse of Alcohol.—Alcohol received into the system is there consumed in the same way as starch and sugar. The energy yielded by it becomes kinetic (that is, expended) in the form of heat or is transformed into muscular strength. It takes the place of other food-ingredients in the actual nourishment of the body. These are the facts of physiologic research, of laboratory experimentation, and as such are beyond dispute.

Few physicians of experience will deny the great advantage often to be derived from alcohol in combating the weakness due to the poison of fevers and in maintaining nutrition in certain debilitated states; but neither will they deny that the kinetic energy stored up in the **healthy** tissues of a man from one or two ounces of alcohol is likely to be expended in ways detrimental to that individual's **future** nervous, mental and moral welfare.

Alcohol is certainly more or less a poison for nervous tissues. It disturbs their healthy activity, and when taken constantly into the system, even though the daily amount be small, it sooner or later causes organic changes. Persons of nervous temperament, so-called, should especially avoid the use of alcoholic stimulants. The discomfort of the after-depression, even from the use of very small amounts, much more than counterbalances the temporary increase of energy produced.

Occupation and the health of the individual are important in regard to the advisability of using alcohol. In very healthful out-of-door work, by vigorous men, alcohol has often been used in large amounts even for years with little if any apparent ill effect. But the in-door worker has a very different experience and the danger to him is twofold because he is more apt than the more healthfully employed outdoor worker to feel the desire of stimulation. This danger is best met, not by mere passive self-denial, but by the care-

ful maintenance of good health—as much outdoor life as possible being rigidly taken by the man whose daily work is indoors.

The matter of the use of **tea, coffee, and tobacco** allows of a wider range of debate. A cup of coffee in the morning usually does no harm, and is often conducive to a satisfactory movement of the bowels. Here it is, however, especially true that everyone must be guided by their own experience. Coffee certainly often is the cause of much ill-health or poor, wretched health. The excessive use of tea, to which many nervous women are addicted, often to the exclusion of nutritious food, is, however, particularly to be deprecated. The man of weak nerves must use tobacco either not at all or only with the greatest discretion.

The virulency of the syphilitic poison on the nervous system and the subtle way it attacks it—oftentimes years after the primary inoculation—has been the subject of volumes. Of the large number, especially of the young and middle-aged, who are yearly stricken with a sudden paralysis of one side, or of one extremity, or who, for no apparent reason except the common but wrong one of "overwork," sink gradually into the gloom of complete dementia—of all these the majority are its victims.

The lesson in moral hygiene, thus relentlessly taught, is the necessity for the early and firm building of character as the only sure and strong nervous and mental safeguard. American parents, though neither more indifferent nor more careless as regards the mental and moral welfare of their children than people of other countries, need, however, to have it firmly impressed on their minds that, in a country like theirs, where independence is the watchword, this independence cannot with safety be applied to Nature's laws. Liberty is not license, but too often the latter is indulged in under the mistaken idea that it is the former. If parents would have their children preserve their mental and nervous balance under the appalling vicissitudes of fortune so common in this country, they must early inculcate such saving principles as fortitude, self-denial, and self-control.

OVERWORK.

As the direct cause of nervous and mental breakdown overwork, both physical and mental, has been much blamed. Therefore the measures which may be taken to avoid it are of prime interest since we all work and are liable to carry it too far. Rules, however, which will fit every case are clearly impossible, because the whole subject

resolves itself into the question of personal capacities and limitations. Everyone who observes his bodily and mental conditions must be fully cognizant of what Dr. Oliver Wendell Holmes (Over the Teacups) called the "curve of health." In this author's words: "It is a mistake to suppose that the normal state of health is represented by a straight horizontal line. Independently of the well-known causes which raise or depress the standard of vitality, there seems to be—I think I may venture to say there is—a rhythmic undulation in the flow of the vital force. The 'dynamo' which furnishes the working powers of consciousness and action has its annual, its monthly, its diurnal waves, even its momentary ripples, in the current it furnishes. There are greater and lesser curves in the movement of every day's life—a series of ascending and descending movements, a periodicity depending upon the very nature of the force at work in the living organism. Thus we have our good seasons and our bad seasons, our good days and our bad days, life climbing and descending in long or short undulations, which I have called the curve of health."

This very shrewd observation contains the elements of a practical and satisfactory working rule. Every one should give due heed to the ebb and flow of his vital forces and regulate his periods of work and rest to suit them.

Mental Overwork.—Many persons either do not know or do not heed the fact that intellectual activity is based on material substance which is subject to wear and waste and needs repair by food and rest. A literary man hard at work, with an ice-cap on his head and his feet in a pail of hot water, is a picture. That emphasizes the fact that the mind does not work without affecting the physical part of us.

Physiologists have shown that intellectual activity is always accompanied by a marked increase in the amount of blood circulating in the vessels of the brain, evidencing the need for more food to the brain and better removal of waste. On this account we should not bring about this condition at a time—we should not do brain work of an absorbing nature—when the blood thus attracted to the brain is urgently needed for the proper functional activity of the processes elsewhere in the body, notably **digestion**, against which we most often are law-breakers. The large number of cases of stomach and intestinal indigestion in brain-workers who persist in pursuing their work immediately after eating is good proof of the truth of this.

Intellectual and digestive processes cannot even once with comfort, or with health continually, be called into play at the same time.

The morning would seem to be the time when the brain, after the repair wrought by a night's rest, possesses the most energy and vim, and it is then that the bulk of intellectual work should be done. The power of continuing work at full pressure is, of course, widely different for different workers and for various kinds of work. About 4:30 p. m. the vitality of the nervously weak often reaches its lowest ebb. There is, however, usually a subsequent increase in mental vigor derived from the evening's meal. The fatigue which gradually comes on and finally induces sleep is likely due more to exhaustion of the cell's supply of assimilated food than to the accumulation of waste-products in the blood, but both play a part. It would certainly be of great benefit to brain-workers if they took the hint from Nature and arranged their periods of mental activity and rest to suit the daily curve of nervous energy. That portion of brain-rest which is obtained in sleep should be secured during the hours between 10 o'clock at night and 8 in the morning. The brain-worker requires more sleep than the laboring-man, and he is certainly doing himself an injustice, from which his nervous system will sooner or later suffer seriously, if he attempts to get along with less than eight hours' sleep.

Every now and then an article in some popular magazine informs us that some favorite author works at hours, and with an amount of sleep, which set all the laws of Nature at defiance. Whether this performance is exploited to stimulate the ambitious young man or woman to do likewise or not, is not known, but it is easy to detect in the work of such an author proof of an unusual lack of sustained effort. The world would be far better off without much of what comes to us in the guise of literature, but is in reality the product of the same sort of brain activity that occurs in bad dreams and nightmare. Occasionally great thoughts may force their way into the consciousness during the dead of night, but these occasions are so rare that we may with safety lose the little sleep that we would have while writing them down. The effects of intellectual employment during the normal sleeping-hours are too often seen in the cases of neurasthenia in editors and reporters on morning newspapers which are prepared in the midnight hours.

Worry.—The brain, under proper training, is capable of doing an immense amount of work, if it is of a varied character and does not induce a large amount of emotional excitement. The importance of the emotions, especially the depressing ones, such as grief, anxiety,

and worry, as factors in brain exhaustion, is readily recognized. This theme, however, has been harped upon so much by writers on nervous diseases that the country seems at last to be awakening to the fact that some united effort should be made for emancipation from at least one of the list, and we now have the "Don't Worry" Society, numbering among its members hundreds of brain-workers. This movement is certainly commendable and will no doubt have a most beneficial result. The old saying, "Not work but worry kills," is particularly true with respect to brain-work. A mere fit of low spirits may temporarily hamper a man in the use of his intellectual faculties. The turn of events and the softening influence of lapse of time will restore him to the normal. For the man who is constantly worried, however, neither time nor circumstance is likely to do more than add to his overdose of unrest and misery.

Mental Recreation.—A brain working in a single rut, under a heavy emotional strain, as in the case of inventors, speculators, promoters of daring schemes, is very liable to come soon to the limit of its forces. The brain does not rest as a whole, but its parts may be unequally active, or some parts may be quite at rest, while others are fully active. **Change**, then, is the salvation of the man who has absorbing or difficult daily work, for only by calling forth other activities can the part of the brain at work be given leave to take even much-needed rest. Thus the office worker takes up his golf clubs, the professor puts together his rod and reel, the doctor goes to the bowling-green, and the stock broker goes on his yacht, and all are rehabilitated and renewed for the morrow.

But the recreative occupation must be pleasing and as different as possible from the serious business of the day. It is a great mistake to try to rest an overworked and harassed brain by a feverish tour on the continent, or by a few weeks' unwilling stay within the dull confines of a country village.

> "They change their skies but not themselves,
> That cross the seas,"

expresses the case very well; it is not change of place that is necessary but change of person—be something else and be renewed, feel like a new man when you go back to your regular occupation.

The average stock broker or scheme promoter cannot become a shining light in art or letters. There is nothing lost, however, because such a person's efforts are not crowned with success, whereas

the gain to him from the healthful mental gymnastics involved is often incalculable.

Fads, or hobbies, are most valuable in this matter of recreation. They need not be expensive nor require much time. The brain-worker who can afford no greater outlay than that involved in the fad of stamp-collecting on a small scale has in it just as great a means for nervous salvation as one whose bank account enables him to acquire a museum of art treasures. In one instance complete mental prostration of an overwrought young woman was averted by her turning her attention to the study of the different weaves of oriental rugs. The collection of book-plates, rare books (often not expensive, though pleasantly elusive), old china and furniture, and old prints are some fads, of which the list might be indefinitely extended. Many others, including the most appropriate, will be suggested by a study of the circumstances of the individual case.

Lack of time may be urged against all this, but all time spent in preparing one's self for a sanitarium, or, worse still, for a lunatic asylum, is like the proverbial edged tool in the hands of children and fools. Better divide the time and use even a generous part of it in the fad or anything else that will keep one in health and happiness of mind and body.

Physical Overwork.—The muscles are but the organs or tools of the brain. All motor activity is the result of the expenditure of nervous energy, and bodily fatigue is in reality nervous fatigue. The muscles, of course, also undergo changes as the result of activity, but such changes are only of secondary importance as compared with those which go on in the nervous system.

The nerve-cell is connected to the muscle-fiber by a so-called "end plate," or "terminal plate," which is intimately applied to the muscle-fiber. The end plates can be paralyzed by **curari** (also spelled **curare, oorari** and **woorari**), a poison used by South American Indians on their arrow tips. This poison by its action on the nerve end plates prevents the nervous impulses from reaching the muscles. Hence, there is paralysis, although the muscle-fiber and the nerve-cell are not affected. Any similar effect is termed "curarization."

"Spontaneous curarization" occurs in fatigued muscles through the action of toxic substances formed during and as a result of muscular action. This the following experiment shows: A current of electricity was passed through the body of a frog from mouth to anus so as to produce complete **tetanization** (or continued rigidity, which is the maximum of muscular contraction) in a given time. The current

was then shut off and the frog left undisturbed for a time. On then re-applying the electricity it was found that the muscles of the body, tired after the first excitation, were not capable of a new tetanization. They were, in fact, quite exhausted. However, if the nerve of the left hind leg were then excited by the electric current very little or no contraction resulted in that leg, but when the current was applied to the nerve of the right hind leg—whose artery had been tied—strong contractions in this limb resulted. The muscles of the left leg could still be made to contract by **direct** application to them of the electricity. Therefore they were not paralyzed or poisoned in themselves. The nerve of the right leg was electrified in the part of it **above** the **ligature** that was used to protect the right leg from the poisoned blood—that is to say, this nerve was stimulated in a part that was acted on by the poisoned blood just as in the case of the nerve of the left leg. Yet the right leg muscles contracted, showing that **the right nerve could still conduct impulses.** It was not poisoned.

This experiment shows that the toxic substances produced in the body by the activity of the muscles exerted a paralyzing influence through the blood in which these poisons were carried to other muscles. The poisons act upon the end-plates of the neuro-muscular system rather than directly upon either the nerves or the muscles proper.

It may be stated plainly that there is no need of building up a vigorous muscular system—with all the output of energy which this process entails—as a safeguard to the maintenance of healthy mental and nervous balance.

In this regard Dr. Oliver Wendell Holmes says: "Do not think that a robust organization is any warrant of long life, nor that a frail and slight bodily constitution necessarily means scanty length of days. Many a once strong-limbed young man and many a one-time blooming young woman have I seen falling and dropping away in or before middle life, and many a delicate and slightly constituted person outliving the athletes and beauties of their generation. Whether the excessive development of the muscular system is compatible with the best condition of general health is, I think, more than doubtful. The muscles are great sponges that suck up and make use of large quantities of blood, and the other organs must be liable to suffer for want of their share."

"Mens sana in corpore sano" does not mean that if we are to become intellectual giants we must set about acquiring the muscular

force of a dray-horse. None of the shining lights of pugilism are conspicuous in the arena of art or letters.

It is not even true that the day laborer, well muscled as he is, generally is equally gifted in the matter of nervous system. The deadly monotony of his unvaried work, with its lack of emotional reaction, not infrequently proves the undoing of his mental and nervous stability. If any one desires to test this, let him carry stones from one pile to another at a distance, say, of fifty feet, just dropping them down without regard to their arrangement, and when the first is exhausted, carry the stones of both piles back, one at a time, until both are heaped upon the site of the first. A very few repetitions of this process will convince the experimenter that complete mental and nervous demoralization would soon result from its continuance. Muscular exercise, like brain exercise, in order to be potent for the highest physical, mental and moral good of the body, must be varied and such as to provoke pleasurable emotions.

The power of worry to cause **mental** exhaustion has been discussed already. It has equal capability to consume muscular energy. Contrast, for example, the utter weariness produced in the young physician—if he be conscientious—by his first few cases, and the freshness with which his older, steadier-nerved confrère accomplishes even much more in his daily rounds. The physical condition of the mother who has nursed her child through a long illness is one of vastly greater exhaustion than that of the paid nurse who has done the same amount of fatigue-producing work, but without the emotional strain to which the mother has been subject.

Regulated Physical Exercise.—While fatigue is recognized as Nature's imperative "Stop!" muscular exercise may safely be indulged in. Most people get all the exercise they need in the routine of daily life. For the sedentary and nervously constituted, however, special provision must be made in order that they shall have a right amount of physical exercise. A daily **walk** of three or four miles in the open air, at the rate of about three miles an hour, is sufficient for the ordinary man of sedentary occupation. The problem as to the nervously weak person is much more difficult and entails a study of the individual case. Some nervous invalids cannot use their muscles at all without an expenditure of nervous force which leaves them bankrupt for weeks. For these nothing more than massage and carefully regulated passive motion is desirable, or, indeed, allowable. Others again suffer from a "paralysis of volition"—they lack only the necessary will-power to make what is, for the time being, a not altogether pleas-

ant exertion, but are really capable of doing a great deal more than they think. They should be handled with the greatest circumspection. Their exercise should be taken only in the open air. The monotonous round of Indian clubs, chest-weights and dumb-bells is to them often worse than nothing, being invariably irksome and quickly fatiguing. These persons need gymnastics in which the mental element is greater than the physical, a form of exercise best exemplified in lawn-bowling, but also very well by golf.

Golf is one of the greatest boons there is in the way of outdoor exercise for the nervously weak—man, woman or child. The player's scene of action is constantly shifting. It involves more walking than any other game. Indeed, on the physical side it is principally walking, but with changes to the use of other muscles, especially of the back and arms, that are very helpful. Mere walking is considered to be one of the best forms of exercise, but it lacks a "point of interest" very often and thereby loses most of its value. In gclf there is always a point of interest (the ball) that is quickly reached, but that takes an effort of the mind to find, which is most beneficial to the person whose mind needs rest by a change. The mind finds both restful and absorbing occupation in the calculation of distances and in regulating the necessary coördination of the muscles involved in the various strokes. There is no need for any violent efforts, hurry or emulation, and the player may always stop at the first signs of fatigue. The golfer, however, is usually so completely interested in the matter of "hazards" and "bunkers" that the distance traversed is not appreciated, and delicate women often say that they are able to go farther, without fatigue, in pursuit of a wayward golf-ball than they had ever thought possible.

But golf must be played to give one the least idea of its pleasure and fascination. No amount of description will convey to the mind of one who has never played how much there is in the game, and it is amusing to witness the rapid change of heart which is undergone in the first round by the man who belittled the sport as being childish. There is a sufficient range in the necessary outlay in money for an outfit to suit any purse. Three clubs and three or four balls is as complete an equipment as any ordinary player could wish, and a caddie should not be allowed to deprive the game of a good part of its virtue—the exercise of the muscles of the back and legs which one uses in picking up a club off the ground.

Bicycling.—For the more vigorous and self-reliant neurasthenic bicycling is excellent, but its usefulness is limited largely to male

sufferers. The nervous strain which is involved in the effort of timid and weak women or girls to learn to ride is often disastrous.

The use of the wheel implies work, often hard work, but it, even more than golf, affords a constant change of scene. To the experienced rider the peculiar sensation, as of flying, often felt while wheeling along a pleasant road on a fine day, is very exhilarating, and gives him a sense of new vigor. Nervous but plucky patients can often ride the wheel several miles with comfort, but cannot cover the distance of a few blocks on foot without great mental as well as physical suffering. And in some cases this achievement marks the turning-point in the road toward the recovery of nervous health.

Tennis is in most cases much too violent and exhausting for a person with a weakened nervous system. **Canoeing** and **boating** are excellent for those who have fair self-command. In addition to the output of muscular energy they both bring into play the balancing and coördinating faculties, and have the charm of being carried on with little effort on one's own part—a charm which is a part of the pleasure of bicycling, too.

Lawn bowling is one of the best games for adults. Its advantages are: It is not violent nor even severe exercise, requiring, in fact, little more work than croquet; it is therefore suited to weak or convalescent persons, but it also is good exercise for the most vigorous. As the players have to wait their turns, there is also plenty of opportunity for sociability.

Hunting—The neurasthenic with a trained mind and innate, but perhaps undeveloped, love of Nature, always finds the sport of hunting opens up new and varied fields of interest and activity. It may develop, for instance, an unsuspected taste for taxidermy, nearly always brings sight, hearing, touch and smell into a high degree of activity. A physician who found nervous and mental health in the sport says: "Travel was tried with some benefit, but I did not get the best results of my time till I took to the fields and forests—'gun in hand.' I never hunted and never owned a gun until I was past fifty. I studied the habits of birds; used all the skill I could master in my efforts to get a shot, which often requires a great deal of strategy. The eye is constantly under training, the ear also; every footprint of Nature, every motion and sound must be caught and analyzed. If a nut falls, if leaves rustle, or any unusual noise is heard, an immediate investigation must be had, and a quick decision made as to the cause. Thus led by the eye and ear, the muscles of the entire body are called into the most delightful activity, with the least possi-

ble effort of the will, nearly resembling the spontaneous movements of childhood. The muscles seem to obey the active senses with real delight and with much less sense of fatigue than in any other mode of exercise. The muscular system gains in strength, blood is sent to the extremities and to the surface, the skin becomes active, the brain is released of its excess of circulation, the nervous system is rested, the entire man refreshed and renewed."

The modern and humane guise of the hunter—armed with a camera, with which permanent and ever-pleasing "bags" are secured —is quite as excellent as the older blood-thirsty and often wanton sport. The kinds of "game" are vastly more numerous and few, indeed, are the places that would be refused to the camera-hunter.

There are many other modes of outdoor activity which are of the greatest value from a nervous and mental standpoint. Those already mentioned suffice to illustrate the hygienic principles involved. Briefly, the aim in all muscular exertion should be for conservation rather than excessive outpoint of nervous energy in either its physical or its emotional form.

SLEEP.

The circulation in the human brain, laid bare by erosion of the cranial bones, has been compared with the movement of the blood in other organs of the body. Sleep caused a diminution in the number of respirations and a fall of six or eight beats in the pulse. The volume of the brain and its temperature were at the same time slightly reduced through a diversion of a portion of the blood-current to other regions of the body. If during sleep a ray of light was allowed to fall upon the eyelids, or if any organ of sense was moderately excited without waking the patient, his respiration was at once accelerated, the heart began to beat more frequently, and the blood flowed more copiously into the brain. Similar incidents accompanied the act of dreaming. Waking up was followed by an immediate increase in the activity of the circulation in the brain.

Fainting has been thought to resemble sleep, owing to the fact that unconsciousness is a common attribute of both conditions; but the pathologically bloodless state of the brain during fainting is in nowise analogous to the much less marked lowering of blood pressure which accompanies sleep. The attempted analogy between the stupor of alcoholic intoxication and sleep is also highly illogic, and will receive further attention in the consideration of the measures for inducing sleep.

Insomnia, or Sleeplessness.—If the cells in the cortex (or outer gray matter) of the brain can be shut off from receiving stimuli, or messages, from either the outer world or of other parts of the body, consciousness will be so far abolished that sleep will ensue. This gives a rational basis for the prevention of insomnia.

Insomnia is of two kinds: **Functional**, or due to disorder of the organ of consciousness, the brain; and **symptomatic**, or resulting from some disease of some other part of the body. Only the former is here considered. This occurs most commonly in neurotic individuals and in overtaxed brain-workers. It may be complete or partial. Many neurasthenics unintentionally exaggerate the extent to which they suffer from sleeplessness. The pathologic basis of insomnia likely consists in the class of cases under discussion, in a persistence of the hyperemia (or abundance of blood), with its natural anatomic and chemic consequences, which accompanies intense brain activity. There are on even the finer blood-vessels of the brain nerves which directly govern the blood-supply to the brain. These nerves are easily weakened and lose their power to respond at a time when those of other organs of the body respond readily. This being so, the severity of the insomnia will vary with the extent to which the brain is exposed to morbid activity through this excessive blood-supply occasioned by the weakness of these nerves.

Treatment of Insomnia.—For all but the severest cases of insomnia the treatment is simple and easily carried out. Mental work should be done during the first part of the day and restricted to four or six hours. Outdoor exercise is absolutely essential. The bed-chamber should be cool; the bed firm and its coverings light. A fairly long time should be spent in preparation for retiring, but care should be taken that the feet do not get cold during this time, since the sensory stimuli from the uncomfortable cold feet may in themselves be sufficient to keep the brain centers alert and prevent sleep. Undue warmth of any part of the body surface may also cause wakefulness. A warm bath taken just before retiring often will bring about the desired quietness of the skin sensations. Those who persist in going over in their minds the affairs of the past day, or of the next day, after their heads have touched the pillow, should lessen brain-activity by giving the stomach something to work upon, such as a glass of warm milk, a cup of hot bouillon, or even a glass of beer. Any large amount of alcohol should not, however, be taken at this time, since the stupor thus often produced cannot give the healthful restoration of energy which accompanies genuine sleep. The bad effects of

strong coffee taken at night are too well known to need to be insisted on.

Prolonged complete sleeplessness is a very dangerous condition, and the measures necessary to overcome it must consequently be more active. The patient must be regarded as a very sick man or woman, and should be kept in bed; opium and its derivatives, and all so-called **hypnotics** (or sleep-producing drugs), should be withheld. The mere application of mustard-leaves over the upper part of the chest and back for long periods will often relieve unpleasant feelings in the head and produce sleep for several hours. Care should be taken not to blister the skin, since blistering is unnecessarily severe. Counter-irritation may also be secured by bottles of warm water applied to the feet and back, and by warm compresses over the abdomen. Very gentle shampooing or "massage" of the head and neck four or five times a day for a few minutes at a time is generally soothing. This should be done with the fingers spread out, starting from the sides and back of the head, and carried gently down to the lower part of the neck. Food should be given in small amounts at frequent intervals, and the largest meal should come at night. The food will lessen the amount of blood in the brain by requiring an increased blood flow to the stomach and all parts of the abdomen. Gentle rubbing of the whole body, beginning with the lower limbs and working up, is a good way to eliminate waste-products from the tissues. It should not be done after 6 p. m. nor longer than five or six minutes at once. If carried out after six or longer than five or six minutes, it is likely to excite the patient and so defeat the purpose for which it is given. The danger of producing excitement is lessened by using oil on the operator's hands. These measures faithfully carried out will render unnecessary the resort to sedatives and hypnotic drugs, and the danger of vicious drug-habits being formed is avoided.

A very simple way to obtain sleep is the following, which depends for its success on tiring the muscles which turn the eyes in and up. Having assumed a comfortable position and otherwise prepared for sleep, look at an imaginary candle-flame so placed that the eyes must be turned up and in as much as possible. In obstinate cases of sleeplessness it may be necessary to use an actual light in the position indicated. A very dim light answers. The eyes are turned up and in always in sound sleep, as may be seen by raising the eyelid of a child who is in deep sleep. By the above method the eye-muscles soon are fatigued and drowsiness comes on and passes quickely into

natural sound sleep. The method does not lose its efficacy by repetition, but rather gains in quickness of effect.

A glass of hot water or milk at bedtime is a help to some people in getting sleep.

Drugs should never be used except in special cases and then only for as short a time as is absolutely necessary.

INSTRUCTION TWELVE—*Muscular*

Muscular Exercise and Physical Training

Necessary to Harmonious Development of the Body and Mind.

Effect of Muscular Exercise on the Heart and the Skin.

How Fatigued Muscles Are Restored by Use of Sugar, Eggs, Tea, Coffee, Cocoa, Etc.

Spontaneous Movement.

Subject Reference

For Description of the Muscles of the Body, see Vol. 1, pages 19 to 24.

For Diseases of Muscles, see Vol. 2, pages 62, 365, 613.

For Exercises in the Home, see Vol. 2, pages 523 to 530.

In the popular mind the most typical and decisive sign of life is **spontaneous movement.** And this is not erroneous, because while life, in the narrow and strictly scientific sense, may exist without visible and spontaneous movement, yet this is possible for any considerable period only in plants and in some specialized animal cells. Thus the blossom or the bacillus may live and not move, but the bird can not; the nerve-cell and the liver-cell may not move, but the whole man must.

The Muscles.—All the movements that are so characteristic of animal life—both the voluntary movements of the limbs, head, trunk, etc., and the involuntary movements of the heart, stomach, intestines, iris, and other organs—are carried out by **muscles.** These make up nearly **one-half of the weight** of the body of a man, and somewhat less of the body of a child. They are popularly known as "lean meat." The **voluntary** muscles—such, for example, as the biceps, which forms the rounded, fleshy mass on the front of the upper arm, and the gastrocnemius, forming the main mass of the calf of the leg—are connected, usually by **tendons** (which are cords or bands of dense fibrous tissue), to the bones, and hence are also called the **skeletal muscles.** They are made up of long, cylindric

fibers of varying length and breadth, but on the average about 1-500 inch in diameter, and an inch or even two or three inches long. These muscle-fibers are marked with alternate dark and light stripes, which run crosswise; from this appearance the skeletal muscles are likewise termed **striped** or **striated muscles.** Each fiber itself is made up of a number of fine fibrils running lengthwise side by side, with a material of a different nature between and joining them, the whole being inclosed in a thin sheath, called the **sarcolemma.** The fibers are joined together by connective tissue into small bundles, and these again into larger bundles, a number of which make up what we call a muscle. The blood-vessels of the muscles lie in the connective tissue. The blood-capillaries, or smallest vessels, run close to the sarcolemma, but none of the vessels actually enter any fiber. The muscle fibers of the stomach, intestines, blood-vessels, etc., are very much shorter and thinner than the striated fibers, and, having no transverse marks, are termed **unstriped** or **smooth muscular fibers.** Since there is no voluntary control over their action, they are also termed **involuntary.** The fibers of the heart are intermediate in character between the smooth and the striated muscular fibers. Like the latter they are transversely striped, but like the former they are not under the control of the will. They are termed **cardiac** or involuntary striated muscular fibers.

Contraction of Muscles.—The characteristic property of muscular fibers is that when "stimulated" they undergo a shortening or contraction without any change of volume, the length is much decreased while the thickness of each fiber is increased so that the volume remains unaltered. Since the fibers all run lengthwise and are closely bound together in the muscles, the ends of the stimulated muscle come closer together, and if they are attached to bones these are made to execute movements, of which the direction, extent, and force depend on the direction of the pull of the muscle, the nature of the joint at the end of the bone where the movement takes place, the size of the muscle, and the degree of intensity with which it is stimulated.

The contraction of muscle may be brought about **artificially** by stimulating the fibers **directly,** as by striking or pinching them, or by sending electric currents through them, or by suddenly heating or cooling them, or by placing on them some chemical substance, such as common table-salt. All these forms of stimulation can be easily demonstrated on the muscles of a frog which have been cut out after the frog has been killed. In the living body, muscles are generally

stimulated or excited through the **nervous system.** In such a muscle as the biceps every fiber receives at least one branch of a **nerve-fiber,** which is a long branch, or process, of a nerve-cell situated in the gray matter of the spinal cord. These nerve-cells are in close contact with nerve-fibers which come down from nerve-cells situated in the gray matter of the brain. When the biceps muscle is **voluntarily** contracted, "something" (called a **nerve-impulse**), some change in the condition of the nerve, passes down from a certain spot in the gray matter of the brain, along certain nerve-fibers to certain nerve-cells in the upper portion of the spinal cord, and after being modified, perhaps, in these nerve-cells, is then transmitted by the motor nerve-fibers to the muscle. What this "something" is we do not know; no movement nor change can be seen, but it is probably a chemical change, which runs along the nerve with a speed somewhat greater than the fastest express train, successively involving portion after portion of it, as an explosion runs along a train of gunpowder when a lighted match is applied to one end of it. When the nerve-impulse reaches the muscular fibers, it sets up in them changes of a different and much more energetic kind, the external visible evidence of which is contraction of the muscle.

The muscle-fiber, the nerve-fiber, and the nerve-cell are therefore to be regarded as a single machine or as successive links in a chain. If one link gives way, the whole chain is broken; if something goes wrong with one part of the machine, the whole is thrown out of action. Thus, if the nerve is cut across or crushed at any point between the muscle and the nerve-cells (in the spinal cord) from which its fibers come, or the spinal nerve-cells are destroyed by disease, the muscle is not only paralyzed immediately, but in a short time it wastes away, the muscle-fibers disappear and the whole muscle becomes a mass of connective tissue. Similarly, although the process takes a longer time, **removal or permanent disuse of a muscle** or group of muscles (as when a limb is amputated or a joint becomes stiff), particularly in young persons, results in first enfeeblement and then actual decay or degeneration of the nerve-cells in the spinal cord which were connected with the absent or unused muscle. In time even the group of nerve-cells in the brain, to which the spinal nerve-cells are connected by fibers, also show unmistakable signs of wasting or atrophy and tend to disappear. On the other hand, it is exceedingly probable that **increased use of a group of muscles,** especially during the period of growth, **leads to an increase in the size and efficiency of the nerve-cells** of the spinal cord and brain which

are connected with them, just as exercise increases the size and efficiency of the cells in the muscles themselves. This effect of exercise or use of a muscle in causing improvement in the nerve-cells too is a most important fact in regard to the value of rational physical training. It is not only the muscles that are trained and developed, but the nervous system too is developed and improved.

Voluntary Movement, Automatic Movement, and Reflex Movement.—Most of our ordinary movements, and particularly those by means of which we act on our **environment** (or the things about us) and adjust our relations to it, are **voluntary,** i. e., brought about by a distinct act of the will. But nerve-cells connected even with striated or voluntary muscles may discharge impulses that cause **automatic contraction** of these muscles without any voluntary effort of mind and even in the absence of consciousness. Thus, the nerve-cells which govern the muscles used in ordinary respiration (the chief of which are the diaphragm, separating the chest from the abdomen, and certain muscles that elevate the ribs) ordinarily act without a voluntary or conscious effort. Yet we may, and often do, voluntarily change the action of these muscles and alter the rate or the depth of our breathing, but in general we do not think about it, and in sleep, of course, it goes on quite without our knowledge. The impulses that keep the respiratory muscles in action come from a "nerve-center" (or collection of nerve-cells) in the **medulla oblongata,** a portion of the central nervous system which joins the spinal cord to the brain. Although its activity is regulated by nerve-impulses carried to it (by afferent, or sensory, nerves) from the lungs and other organs, thus being **reflex** in its action, still this respiratory center can, even in the absence of such impulses, send out impulses along the efferent, or motor, nerves to the respiratory muscles. It is, therefore, an **automatic** center, and the respiratory movements are in part automatic movements. The best examples of automatically acting muscular organs are the heart and the digestive canal. Their movements are entirely beyond the control of the will, except that some individuals can increase the rate of the heart voluntarily for a short time.

A third kind of movements are called **reflex movements.** Typical examples of reflex movements are the winking of the eyelids when the eyeball is touched, and the drawing up of the foot when the sole is tickled. As everyone knows, both are quite **involuntary,** although they are carried out by voluntary muscles. The nerve-impulses which cause the contraction of the muscles concerned come from

certain groups of nerve-cells which are the **reflex centers** for these movements, and which are situated in the case of the eyelid-reflex in the brain and in the case of the foot (or "plantar reflex") in the lower portion of the spinal cord. The discharge of the nerve-impulse from the reflex center is brought about by the arrival in it of impulses coming by the sensory nerves of the eyeball or the sole and set up by the contact or the tickling. It is not necessary for the occurrence of a typical reflex movement that the person should be **conscious** of the stimulus which gives rise to the reflex, or should experience any sensation from it. Thus, any reflex movements can be elicited while the person is asleep.

Work Done by a Muscle in Contracting.—A muscle is a machine for doing work, but in the scientific sense the term "work" does not mean just the same as in the everyday sense; the former meaning is

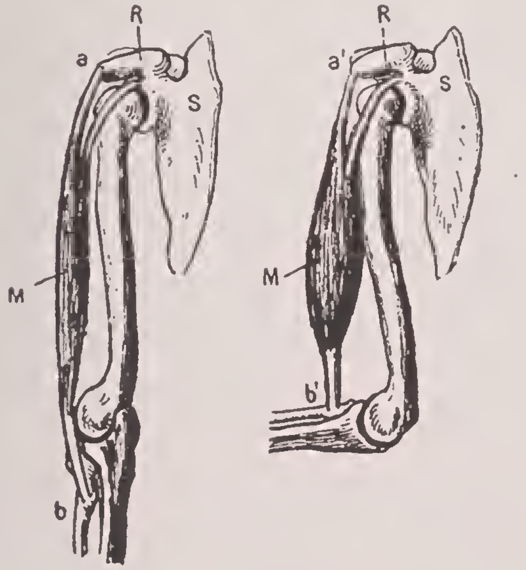


Fig. 95. Shows how a muscle acts. I, Arm extended; II, flexed. M, biceps muscle. R, part of the shoulder blade S, to which the muscle is attached by its tendon a; b, the radius (bone of the forearm).

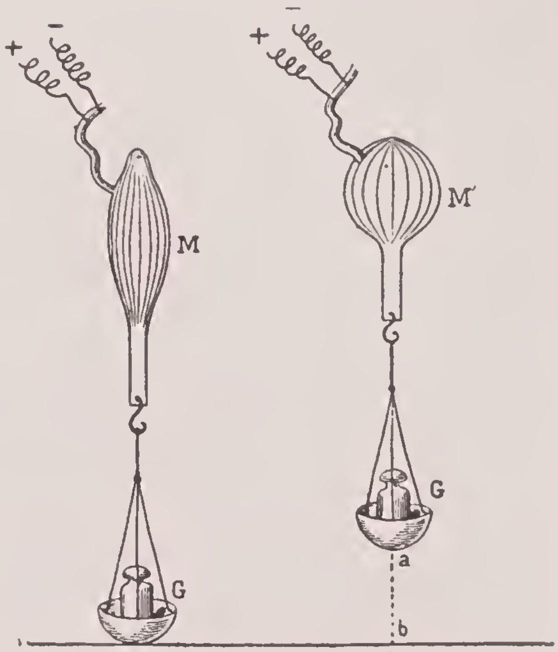


Fig. 96. Diagram to illustrate the action of a muscle. + and — are the poles of an electric battery, by which the nerve going to the muscle, M, is stimulated. The muscle then contracts, owing to the nerve-impulse reaching it, and so lifts the weight G, through the height, a-b, Fig II. The muscle thickens as it shortens. I and II correspond to I and II in the preceding figure.

wider than the latter. Thus, when a man lifts a weight he does work in the scientific sense, whether the weight be a sack of coal, a book, the body of an opponent on the football-field, or his own body as he climbs a ladder or a hill. The **amount** of the work done by a muscle in contracting is measured in terms of the weight which it raises and the height through which the weight is raised. Thus, if a muscle

raises a weight of one pound through a height of one foot, it is said to have done **one foot-pound of work**; if it raises two pounds one foot or one pound two feet, the work done is two foot-pounds, and so on.

Production of Muscular Energy from Food Substances.—No work can be done without using up, or rather transforming, an equivalent amount of energy. Thus, a steam-engine does work by changing a portion of the energy stored up millions of years ago by plants which took it from the sun's rays and from which it is set free in the burning of the coal. And a contracting muscle changes into work a part of the energy contained (and again directly or indirectly derived from the sun's rays) in the food-substances, which are burned (i. e., oxidized) at a comparatively low temperature, in the muscle-fibers. The "burning" of food-substances in the muscle is in effect the same as the burning of coal in the fire-box of the engine, only in the muscle the burning takes place in some peculiar way not at present thoroughly understood at a temperature of less than 100° Fahrenheit (about blood-heat or body-temperature), while for the combustion of coal or of food-substances **in a furnace** a temperature of several hundreds of degrees is necessary. The products formed are, however, about the same whether the food is slowly burned in the muscles and other tissues of the body or rapidly burned in the fire, the only real difference being that in the body substances containing nitrogen (such as white of egg or lean meat) are not quite so completely burned up as they would be in a furnace. The nitrogen is given off in the form of **urea**, which can itself be further oxidized in a furnace to nitrogen gas, carbonic acid, and water. Fat, starch, and sugar are fully burned in the body, the "end-products" being water and carbonic acid, just as if they were burned in a stove.

The muscles are more economical than any machine yet constructed by man, since they can, under favorable conditions, convert one-fourth or even one-third of the energy of food-substances into work, a proportion far in excess of what the best steam-engines can do.

The most important food-substance used in a contracting muscle is a sugar called **glucose**, or grape-sugar. This is formed in the body in digestion of starch and also from ordinary cane-sugar. It also occurs in plants and can even be produced artificially by heating cane-sugar with dilute acids. **Glycogen**, or "animal starch," is also important for the muscles. It is formed in the body from glucose and other substances. It is always present in normal muscles, but as it

is made use of it diminishes in amount, and may even disappear altogether, when the muscles are made to act strongly for a long time (as when spasms are produced in an animal by strychnin). Some **fat** is also always present in muscles, and may be used up during their contraction.

The nitrogenous substances in the muscle do not appear ordinarily to furnish much of the energy of the contraction, for muscular exercise, unless it is severe and prolonged, causes hardly any increase in the amount of nitrogenous substances consumed. This is evident by the fact that the amount of urea excreted is not greater when work is done. On the other hand, exercise causes a marked increase in the quantity of carbonic acid given off by the lungs; and carbonic acid is the form in which the carbon of fats, sugars, and starchy substances leaves the body, serving therefore to indicate how much of these foods is being used in the body when the muscles do work. When, however, the food consists mainly of **lean** meat, which contains little besides nitrogenous food-substances, these are used by the muscles instead of the carbon-containing sugar and fat, which, however, they select when a choice is offered them. But a certain amount of nitrogenous or proteid food is always required by the muscular tissue, for, as in all cells, the real, **living framework** of the muscle-fiber contains proteid substances (i. e., nitrogen-containing substances) as its essential constituents. We may, in fact, conceive of fat and sugar as bearing the same relation to the proper substance of the muscle as water and coal to the steam-engine itself—necessary for its work, yet perfectly distinct from the engine.

RESULTS OF MUSCULAR EXERCISE.

Fatigue of Muscles.—It is a familiar fact that when the muscles work hard for a certain time they become fatigued. The process of fatigue can be best studied when a muscle—for example, one of the muscles in the front of the forearm which by their contraction close the fingers—is made repeatedly to lift a weight. Thus, a weight may be attached by a leather collar to a joint of one of the fingers, and the hand and arm then fastened so that none of the other muscles can assist. The number of contractions and the height to which the weight is raised by each are recorded on a revolving cylinder covered with smoked paper against which rests a pointer attached to the weight that is being lifted. The whole arrangement is called an "ergograph." If the muscle is made to contract strongly and **continuously**, as when a heavy weight is held up by the finger, it quickly

becomes fatigued and soon the weight drops. But if each lift is a short one, and is succeeded by a rest, and if the weight is not too great, the muscle may go on raising the weight again and again for a considerable time. Thus, one of the muscles of the hand lifted a light weight once every second for two hours and a half, or 9,000 times in all, without showing any fatigue. An increase in the weight or an increase in the rate of contraction quickly caused fatigue of the muscle. When the muscle has repeatedly raised a considerable weight with all the force which it can exert, the time at last comes when the height of the contraction rapidly grows less, and sooner or later the effort to raise the weight fails. If the person still strives to raise the weight, a partial recovery of power occurs, after which the muscle quickly becomes fatigued again, and soon refuses to raise the weight. When a muscle is fatigued by voluntary use of it the fatigue involves not only the muscular fibers themselves, but also the nerve-cells in the brain or spinal cord. In fact, when the fatigue seems so great that it is no longer possible by a voluntary effort to cause the finger to lift the weight, **it is the nerve-cells**, and not the muscular fibers, **which first give out.** For direct stimulation of the muscle by an electric current will generally cause it to contract and raise the weight again after the nerve-cells fail.

So far as the muscle is concerned, fatigue seems to be due to two things: 1. The using up of the material necessary for contraction, and 2. the accumulation in the muscle of waste substances produced by the muscle in working. For example, an acid called "sarcolactic acid," which resembles the acid formed in milk when it turns sour, forms in an active muscle.

The effect of food-substances in removing fatigue of muscle shows conclusively that these materials are consumed in muscular contraction. A small amount of **sugar,** for instance, has been found markedly to lessen the fatigue and increase the endurance of soldiers in long marches. We have already seen that of all the food-substances in muscle, sugar appears to be the most important for the work of contraction. The fact that it is rapidly absorbed from the digestive tube and so gets quickly into the blood and reaches the muscle also accounts in part for its restorative effect. Some enthusiasts speak of the almost magic change produced by the eating of a handful of granulated sugar when they are tired. But the action is not a specific one. Sugar may act **most quickly** in restoring fatigued muscles, but other food-substances have a similar effect; thus, **fats,** especially when taken in the form of soups along with certain of the constituents of

meat-extract, will remove muscular fatigue; and so also will the proteid substances contained in eggs and in lean meat. **Caffein,** the active principle of coffee, for a time markedly increases the capacity of a fatigued muscle to do work as measured by the ergograph. **Small** quantities of **alcohol** appear to have a similar effect; larger doses of alcohol depress the muscular power. And it is now well established that in heavy and continuous work or effort, coupled with exposure to all weathers (as in war and in exploring-expeditions), **tea, coffee,** and **cocoa** are much more suitable stimulants than alcohol. All of these things, of course, may be taken in excess. Trainers, also, allow their men no spirits, and only very little, if any, wine or beer.

In addition to the using up of the substances necessary to contraction of the muscles, **the production of waste-substances** more quickly than they can be removed is partly responsible for the fatigue. This is shown by the fact that the blood of a dog completely tired out by running, when injected into the veins of a perfectly rested dog, produces in the latter all the symptoms of fatigue. When the blood of a rested dog was injected into another rested dog no fatigue resulted. The marked effect of massage of the muscles in overcoming fatigue shows that the passage of the excess of waste-products from the muscular fibers into the blood and lymph is favored by the kneading of the muscles. This increases the flow of the blood and lymph through the blood-vessels and lymphatics of the muscle.

The **flow of blood and lymph** through the vessels of the muscles is physiologically increased **during contraction.** This is a very beautiful provision for giving the active muscle that increased supply of food which it requires, and for carrying off at the same time the excess of waste substances produced in the muscle. This increase and flow is brought about in two ways: 1. By the widening of the small arteries, and therefore of the capillaries, of the muscle, by the action of certain nerve-fibers[1] which govern the caliber of the arteries, and which act on the vessels whenever the muscle contracts; and 2. at the beginning of the contraction by the increased pressure on the veins that carry the blood away from the muscles. These veins, like most others, are provided with valves in their interior which permit

[1] There are certain nerve-fibers called *vaso-motor* fibers which act on the blood-vessels by increasing or diminishing the degree of contraction of the smooth muscular fibers in their walls. These muscle-fibers encircle the vessel or have a circular direction. Hence by their contraction the vessel is narrowed, and when they relax the vessel widens.

the blood in them to flow only **out of the muscles and toward the heart,** but not back to the muscles. When the veins are pressed on, therefore, by the contracting muscle, the flow towards the heart and away from the muscle is increased. Thus, the quantity of blood flowing through one of the muscles used by the horse in feeding was observed to be three times as great when the animal was engaged in chewing oats as when the muscle was at rest. This was shown by opening the vein coming from the muscle, measuring the blood from it for equal periods of time, first during rest and then during eating. The increased flow of blood is one of the local effects of exercise, and doubtless the increased supply of nourishment to the muscle is connected with the growth of muscles that are freely exercised, as is strikingly seen in the "brawny arms" of the blacksmith and the general muscular development of the professional pugilist or athlete.

There are also certain **general effects** of exercise which are of great interest and hygienic importance.

The Effect of Exercise on the Heart.—Even a moderate amount of exercise causes the heart to beat more quickly. Thus in 74 healthy men it was found that running up and down two flights of stairs caused an average increase of 32 pulse-beats per minute, or nearly 50 per cent of the normal pulse-rate at rest (which is about 73 in the minute sitting, about 80 standing). The increase, however, was very different in different individuals, one man having a pulse-rate immediately after the exercise of 164 and another of only 75. This shows that different individuals have very different capabilities for work or exercise. Unless the amount of exercise is excessive, there is still a steady, regular rhythm of the heart-beats, so that the right ventricle sends more blood through the vessels of the lungs and the left ventricle more blood through the rest of the body than when the person is at rest. The respirations are also increased by exercise. The increased flow of blood through the lungs permits more oxygen to be taken into the blood and more carbonic acid to be given out. Both of these circumstances are favorable to the active muscles, which use up far more oxygen and produce far more carbonic acid than muscles in repose. Therefore, the quickly yet strongly beating heart is the ready helper of the hard-worked and hungry muscles with their rapidly accumulating waste-products and their dilated blood-vessels. This response of the heart to the need of the muscles is brought about by nervous influences, and is a good example of the work of the nervous system in giving unity to the parts of the body.

Exercise and Respiration.—The increased amount of oxygen to be

obtained by the blood as it passes through the lungs, and the increased amount of carbonic acid to be discharged, requires that more air be taken into and breathed out of the lungs. The respiratory movements, as well as the heart, are accordingly quickened during exercise. This quickening of the breathing is brought about by the action of the respiratory center in the brain, and is due: 1. Partly to the sensory, or afferent, nerves of the active muscles, which carry impulses up to the respiratory center (from which impulses go continually to the respiratory muscles); and 2. partly to the direct effect of the carbonic acid (and perhaps other substances produced by the muscle) on the respiratory center as they are borne through it in the current of the circulating blood.

Exercise and the Skin.—Another general effect of exercise is to redden the skin by the dilatation of its blood-vessels, and to increase the excretion of sweat. The increased blood-flow through the cutaneous vessels of the skin heats the skin itself, but cools the body, since more heat is given off from the skin when warm than when cold. The evaporation of the sweat also has the effect of taking more heat from the body. In both of these ways, as well as by means of the increased ventilation of the lungs, the excess of heat produced in the active muscles is gotten rid of. The temperature of the blood, even during the greatest physical exertion, seldom rises much more than a degree.

The effect of exercise on the digestive system, when it is regular, taken at the right time and not too great, is favorable. The appetite is increased; food can be taken not only in larger quantity, but with better relish, and it is more fully and rapidly absorbed from the stomach and intestine, and more completely oxidized in the tissues, i. e., fuller use is made of it.

Physical Training.

Relation to Mental Training.—A watchword of the advocates of physical culture is: "We have not to train up a **soul** nor yet a **body**, but a **man**, and we cannot divide him." This is a truth which lies at the basis of rational education. The strongest plea for systematic training of the body is that it helps in the harmonious development of the **whole man.** The effects of muscular exercise on the nerve-cells in the spinal cord and brain that are connected with the muscles has already been referred to. The muscular fiber, the nerve-fiber and the motor nerve-cell lie close together in the "bundle of lip." So-called "muscular fatigue" is in part fatigue of the nerve-cell. So-called

"muscular training" is at the same time a training of the nervous centers. What we term "muscular agility" is but the outward expression of a nervous agility, in which incoming impressions are readily received by and resulting outgoing impulses to muscles are promptly discharged by certain individual nerve-cells and groups of nerve-cells, extensively connected with each other and drilled to act in concert.

The effects of muscular training are not confined to the motor centers of the brain and spinal cord. Other portions of the brain as well are affected, even those portions which are especially related to mental processes. Many of our ideas, and some of them apparently the most abstract, have been shown to be dependent for their completeness and vividness on the memory of muscular movements. Thus, when we think of a circle we involuntarily go through in memory, although not usually with our muscles, the movements of the hand necessary to draw a circle or the circular sweep of the eyes necessary to view it. This is, of course, not everything that is involved in the idea of a circle, yet it forms an essential element in the idea. The education of the nervous centers which have to do with the perception of ideas and with intellectual operations would be extremely incomplete without education of the centers connected with muscular movements. Sir James Crichton-Browne, a distinguished writer on mental diseases, even speculates upon the possibility that "swaddling-bands so applied at birth as to restrain all muscular movements, and kept on during infancy and childhood, would result in idiocy—a speculation to which the wretched muscular development of most idiots and imbeciles, and the fact that their mental training is most successfully begun and carried on through muscular lessons, give some countenance."

Besides being necessary to the full development of the mental powers, physical education teaches discipline, obedience and courage. It has three main objects: "To confirm health, to give a harmonious development to the body, and to teach how best to utilize the muscular force in the different applications which are demanded in life."

The most advantageous kind of exercise has not been definitely agreed upon by the experts, and the nations are more apart in practice than the experts are in their opinions. By the Americans and the English outdoor games and athletic sports are preferred. The Germans, and more especially the Swedes, are patrons of systematic gymnastic exercises intended to develop in due order and proportion all the muscles of the body. The right practice probably lies between these two extremes. Open-air sports and regular gymnastic exercises

should both have a place in the physical training of children and young people during the period of growth. Outdoor sports and games are carried on, in general, under far healthier conditions and afford a greater amount of exhilaration (and, therefore, of **recreation**) than set exercises conducted in a gymnasium or in a stuffy bedroom. The former are usually enthusiastically indulged in and are not so liable to be shirked on slight pretexts. But development of muscles and the education of movements produced by them is apt to be haphazard and lopsided. They should, therefore, be **supplemented** by a system of regular gymnastics.

In childhood and youth systematic training of the body produces the greatest results, as this is the period of development. Growth continues throughout the first twenty-four years of life, which time may be divided into three equal periods. Dr. Hartwell, the superintendent of physical education in the Boston public schools, who has had great experience in this matter, comes to the following conclusions:

The first period of growth is from birth till the close of the eighth year and is characterized especially by the great increase in size and completeness in structure of the brain. Both games and gymnastics are valuable during this period. But they should be simple, and should be designed rather to develop such fundamental movements as those employed in walking and running, in bending the body, and in maintaining the erect posture, than to acquire such skilled movements as those of the hands and fingers in playing the piano or the violin. Handling many kinds of tools, or such rapid and highly co-ordinated movements as are necessary in many games are not useful in this first period.

The second period extends from the beginning of the ninth to the end of the sixteenth year. It is the time of most rapid growth in height and weight. The increase in weight is due chiefly to the growth of the muscles. The power of co-ordinating movements (i. e., of using several sets of muscles at once) advances far beyond what was possible in the first period. This period is the most important one for physical training, and neglect of it at this time can never be perfectly remedied later on. Both athletic sports and gymnastics are important as agents of physical culture in this stage, and the "forms of exercise should be more varied, complicated, and difficult than in the previous period."

The third period includes from the beginning of the seventeenth to the close of the twenty-fourth year. This is the period of mental

and moral development. Physical culture should be used to increase and perfect the control of the nervous system over the muscular movements. In particular the vastly important group of skilled movements should be learned. During these years the handicraft is best learned. The delicate control of those muscles which are especially used in skilled work gives the artisan that manual cunning by which he is to earn his bread and which can hardly be fully acquired later on in life. The necessary labors of the workshop may, if carried on under proper hygienic conditions, replace, in part, special physical culture during the later years of this period. When systematic exercises are used, those which educate the muscles (or rather the neuromuscular apparatus) are the best. Up to twelve years of age hygienic forms of exercise should be the main thing.

Sports and Gymnastics.—If a combination of athletic sports and regular gymnastics is the right method of physical training, then what are the best forms of athletic sports and the best system of gymnastics? No exactly definite answer can be given to this question, but if we keep in mind the triple purpose of physical training, viz., to improve and make sure of the health, to develop the body and the mind, and to give the individual the particular form of muscular or manual dexterity which he needs in the serious business of his life, it is easy to make combinations of the two forms of exercise which will secure these things.

Those **athletic sports** that exercise equally the upper and lower limbs, as wrestling, swimming, and rowing with two short oars and a sliding seat, are the best ones if only one is to be practiced. It is seldom necessary, however, and hardly ever desirable, to limit one's self to a single sport. Thus, a game which involves chiefly the legs may be preceded or followed by a game or gymnastic exercise in which mainly the arms are used. It is in so graduating and varying the movements as to exercise every muscle in its turn that scientific gymnastics is superior to mere athletics; and of all the systems of gymnastics that by Ling, expanded and promulgated by Zander, and known now by the name of **"Swedish movements"** appears to be the best and most complete. These were first devised and put in practice by Ling, but it is not possible to more than mention the subject here. In a subsequent chapter full directions for gymnastic exercises are given under "Home Gymnastics."

The amount of exercise which should be taken varies for different people and different times. Many people who take no systematic exercise at all remain in good health. The daily work often provides

as much as is required, and if the conditions under which manual labor is done are **healthy**, it would be quite superfluous to insist, in addition, on a weary round of gymnastic exercises. The gentleman farmer whose physical exercise is limited to riding about his fields or following the hunt, might be benefited by regular gymnastics. Even the greatest enthusiast for physical education, however, would scarcely expect the hard-working farmer or navvy at the end of his day's toil to find his most profitable relaxation on the horizontal bar or even toying with Indian clubs. According to Parkes, an ordinary man should take an amount of exercise equivalent to about 150 foot-tons through a height of one foot. This is about the same as walking 9 miles on a good, level road, or cycling about 25 miles at a moderate pace, say 9 miles an hour. But as the cyclist increases his speed the expenditure of energy increases more rapidly owing to the greater resistance to his progress due to the air. Of course a certain (usually a fairly large) amount of bodily exertion is involved in the daily work of all healthy persons; to this extent the amount of systemic exercise may be lessened.

Too Much Exercise.—Exercise ceases to be beneficial to the body when carried to the point of exhaustion. In fact, the severe strain of prolonged exertion may cause **dilatation** (i. e., over-distension, or over-stretching of the muscle-fibers) **of the heart**, and even **injuries to its valves**; or some of the large arteries may be over-distended and some of their coats give way—a condition known as **aneurysm**. Temporary dilatation of the heart has even been observed in soldiers after a long march in heavy marching order, and also in runners after a hard race. A very rapid, unequal, and irregular heart-beat (or pulse) shows that the exercise is excessive and must be begun less vigorously and gradually increased.

Certain **diseases of the respiratory organs** may also be caused by too severe or unduly prolonged exercise. Morally, however, the severest exercise may be of great value and benefit. Thus, "The grim determination which keeps the football-player in the field in spite of bruises and exhaustion may be very unphysiologic and even injurious as regards the muscles, but not necessarily so as regards the **moral fiber** of the man. For it is sometimes well in more important moments in the march of life that when the weary muscles cry 'Halt!' the steadfast will should cry 'Onward!' and compel the muscles to obey." But as physical training, exercise should always stop before it becomes exhausting. This is true especially in the first and second periods of growth. Muscular relaxation is the natural consequence of muscular contraction, and rest must balance exercise.

Ventilation and Clothing.—When exercise is taken in a gymnasium there should be most thorough ventilation. The removal of carbonic acid by the lungs and the demand for oxygen by the muscles are greatly increased, calling for lots of fresh air. No tight clothing which hampers the free movements of the chest should be worn. For many kinds of indoor exercise the upper part of the body should be stripped. There is no danger of taking cold so long as the exercise goes on, but at once when it is over, as well as in the intervals of rest, the body should be covered. In winter the room or gymnasium should be moderately warmed, but never hot.

Exercise in Disease.—In many diseases local treatment of the muscles, either by massage (that is, stroking, striking, rubbing, or kneading) or by movements (either **passive,** i. e., carried out by a nurse or assistant, or **active,** i. e., carried out by the patient himself), or by a combination of movements and massage, is used to hasten a cure. In very many diseases no other treatment is so effective. Thus, in certain forms of dyspepsia, habitual constipation, gout, derangements of the function of the liver without any change in its structure, obesity, neuralgia (including sciatica), nervous prostration, some forms of paralysis (especially the acute paralysis of children), locomotor ataxia, St. Vitus' dance, writers' cramp, muscular rheumatism, some forms of dropsy, certain diseases of the heart and blood-vessels, lateral curvature of the spine, and sprains—in all these much benefit and often a cure may be gained by one or other of the above methods

INSTRUCTION THIRTEEN—*Voice and Respiration*

Subject Reference: For Respiratory Organs, see Vol. 1, pages 40-44. For Artificial Respiration, page 467.

For Surgical Treatment of Mouth, Throat and Gullet, see Vol. 2, pages 164-173.

For Diseases of the Mouth, Nose, Throat and Lungs, see Vol. 2, pages 373-393.

Speaking and Breathing

How to Avoid Catching Cold.

Care and Prevention of Diseases of the Nose, Mouth, Throat, Chest and Lungs.

The Nose.

The nose consists of an outer or facial and an inner part situated within the bones of the head.

The outer nose is bony in its upper part only. The lower part contains flexible cartilage and is supported in the center by the septum or dividing partition between the nostrils. It has muscles which are very important in giving changes of expression to the face, and which can widen or narrow the nostrils.

The inner nose forms two lofty narrow passages which extend as

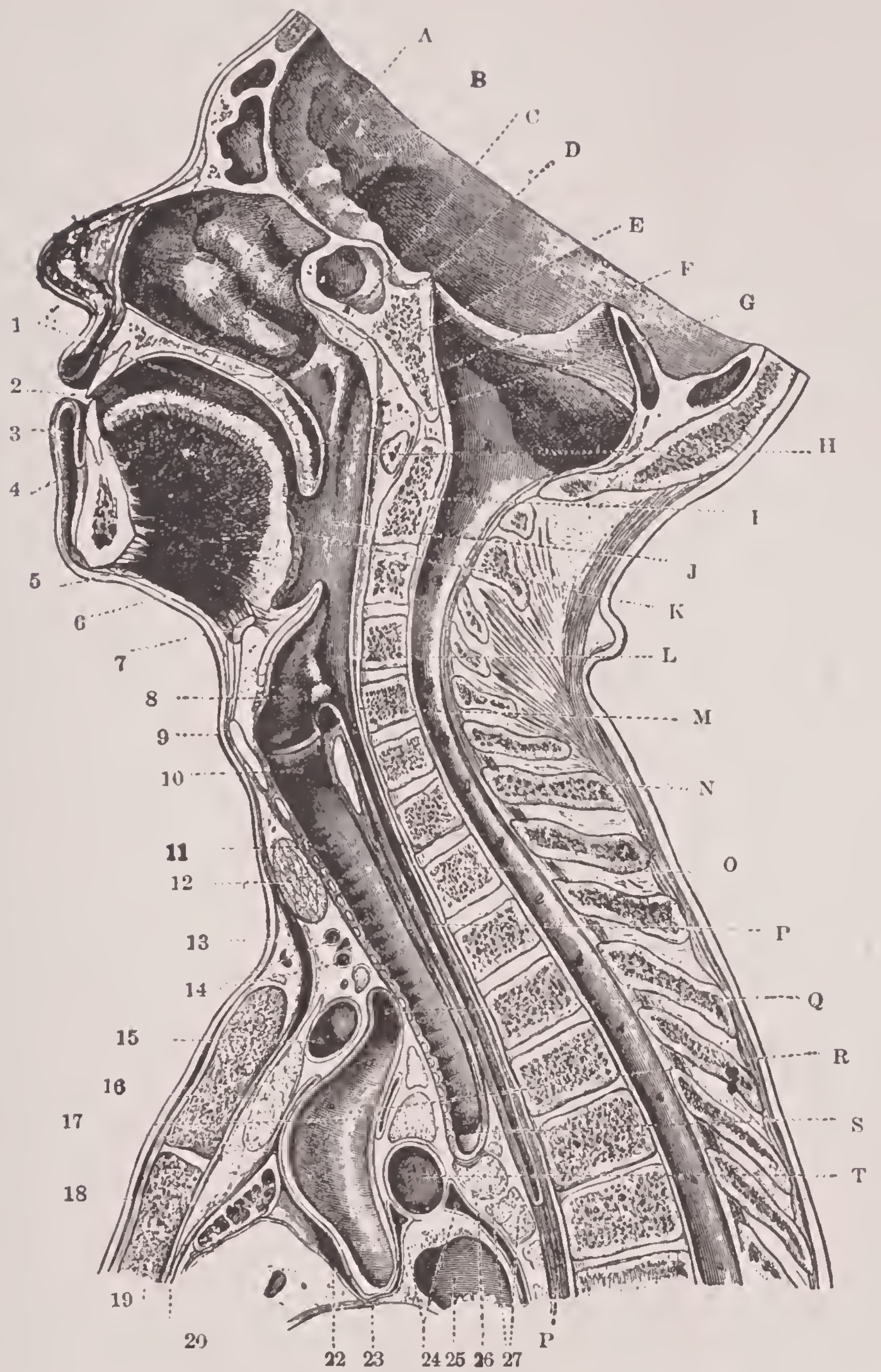


Fig. 97. The middle plane of the head, neck and upper part of thorax. A, Nasal passage. B, Hard palate (roof of mouth and floor space). C, Pharyngeal tonsil (when enlarged it forms "adenoids"). D, Mouth of Eustachian tube (which goes to the middle ear). E, Recess in the throat. F, Pharynx (part into which the nose opens). G, the isthmus of the fauces (opening from mouth to pharynx). H, Soft palate. I, Vertebra. J, Pharynx (part into which the mouth opens). K, Root of the tongue. L, Laryngeal part of pharynx. M, Fascia. N, Last neck vertebra. O, First thoracic vertebra. P, Gullet. Q and R, Large artery and aorta. S, Lower end of windpipe. T, Artery to lung.

1, Mouth cavity. 2, Mouth opening. 3, Space behind lip. 4, Tongue. 5, Small lymph gland. 6, Muscle. 7, Tongue bone (Hyoid). 8, Glottis. 9, Adam's apple. 10, Voice box (larynx). 11, Windpipe (trachea). 12, Thyroid gland. 13, Muscle. 14, Veins. 15, Left innominate vein. 16, Thymus gland. 17, Space for heart. 18, Right auricle. 19, Sternum. 20-26, Parts of the heart and large vessels. 27, Lymph gland in root of lung.

high as the eyebrows and as far back as the hard palate (or hard roof of the mouth). The nasal passage opens behind into a roomy space termed the **naso-pharynx.**

The inner wall of each nasal passage is formed by the **septum** of the nose. This is composed in its back and upper parts of two bones, the **vomer,** or ploughshare, below, and a thin plate of bone above, called the **perpendicular plate of the ethmoid bone.** These two bones join behind to form a solid wall, but diverging in front include, like the arms of a V, the front or **cartilaginous part** of the septum, which is very flexible; if it were of bone instead of cartilage, fractures of this part of the nose would be very frequent.

The outer, lateral or side wall of the nose has a complicated bony framework, supporting three ledges or shell-like projections into the nasal cavities, the **turbinated bodies.** These consist of thin bone covered with mucous membrane, containing a sponge-like network of blood-vessels, forming **erectile tissue,** i. e., tissue which may swell up by the blood-vessels being distended. There are three turbinated bodies in each nostril, called the **lower,** the **middle,** and the **upper.** The lower and the middle extend the whole length of the nasal cavity; the upper is confined to the posterior half. Beneath the lower turbinate there is the opening of the tube, the nasal duct, which conducts the tears from the eye to the nose; under the middle turbinated body is the opening to a thin-walled cavity, which lies in the upper jaw, and is called the **antrum of Highmore.** This cavity lies under the eye, immediately lateral to the nostril or nasal passage, and is surprisingly large. It is lined by mucous membrane.

Accessory Sinuses.—There are other bony cavities opening into the nose in this location, two in the forehead, or frontal bone, and a large number of cells or little air spaces in a very thin bone in the roof of the nose (which is also the floor of the brain-cavity), called the **ethmoid** bone. These chambers of the skull all contain air and are lined by a moist mucous membrane. In **rhinitis** or "cold in the head" the inflammation extends into these cavities and gives rise to the familiar face-ache and frontal (or forehead) headache.

The roof of the nose is formed by the nasal bones in front, or this part may be regarded as the front wall rather than as part of the roof (the nostrils are directed **downward**); behind this a plate of thin bone separates the nasal cavity from the brain. This plate of bone is like a sieve and contains many little holes, which give passage to the nerves of smell. It is called the **cribiform plate** of the ethmoid bone. A hollow bone behind this completes the roof of the nose; it is the body of the **sphenoid** bone.

The floor of the nasal cavity is formed by the **hard palate,** a thick, massive plate of bone which forms also the roof of the mouth.

The mucous membrane of the nose is very sensitive, being richly supplied from the fifth pair of nerves besides having the special **olfactory nerves** or nerves of smell, which are present only in the lining of the upper part of the nose in the so-called olfactory region.

A single layer of minute epithelial cells covers the surface of the nasal mucous membrane, like pavement blocks, each cell having hair-like processes called cilia on its free surface. One such process is a **cilium** (Latin for eye-lash). Numerous little mucous glands keep the mucous membrane moist with mucus.

The best known function of the nose is the sense of smell; but the other functions are even more important to health. The many folds and narrow passages warm the air as it passes over them, and at the same time supplies the air with moisture to the extent of two-thirds saturation. The air, therefore, is not cold and dry as it enters the lungs, but is already warm and moist and therefore non-irritating. The moist mucous membrane of the nose also catches almost all of the dust that enters the nose in the inspired air. The many hairs, or **vibrissæ,** as they are called, which are placed at the entrance to the nostrils, filter out the larger foreign bodies which may be carried into the nose, suspended in the air. Whatever dust lodges on the mucous surface is pushed toward the nostril by the minute cilia, which cause constant outward motion. With the dust any microbes entering the nose are also expelled. In addition to this means of defense by mechanical expulsion, however, the nose probably can also destroy the bacteria by means of its mucus, which is germicidal, so that a very short distance within the nostrils the mucous membrane is comparatively free from microbes.

Obstruction in the Nasal Passages.—To keep the nose and all the air-passages in a healthy state the nasal passage must be open for the passage of air. The commonest cause of stopping up of the nose in children is enlargement of a structure called the **pharyngeal or Luschka's tonsil,** or the third tonsil. This is placed behind the posterior openings of the nose, and when enlarged forms "adenoids," which may reach a large size and may entirely prevent breathing through the nose. Practically all mouth-breathing children have this form of obstruction, the external nasal openings being always open. If this nasal blocking is allowed to persist, it has a very harmful effect on the inner nose, which from lack of use does not develop normally. In such cases the nasal passages at the beginning of adult

life are almost as small as those of a child, while the upper jaw is narrow, producing an ugly protrusion of the front teeth or high-arched roof of the mouth and a characteristic stupid expression.

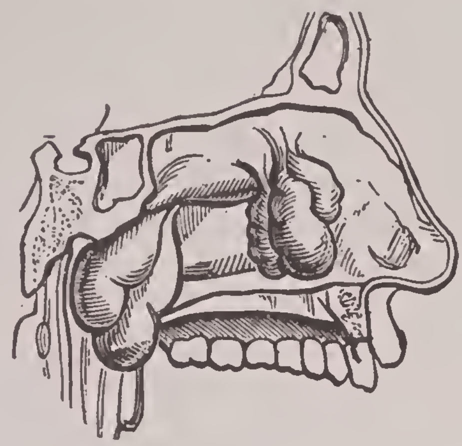


Fig. 98. Polypi of the nose, causing obstruction to breathing.

In adults, nasal obstruction is often caused by **deformities of the septum,** which is either much bent to one side or thickened in such a way as to close up one nostril more or less completely. Other causes of stoppage of the nose of a lasting character are growths or thickenings of the mucous membrane called **polyps.** The most common

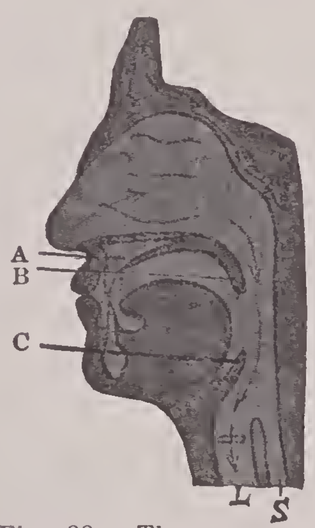


Fig. 99. The upper air-passage (in the nose and throat). A, Hard palate. B, Soft palate. C, Epiglottis. D, Windpipe (passage to lungs). S, Gullet or esophagus (passage to stomach).

Fig. 100. The food passage in its upper part during swallowing. Note that the soft palate and the epiglottis close off the air-passage above and below.

cause of nasal obstruction in grown persons is swelling of the nasal mucous membrane. This is usually temporary only or varies in its intensity.

Mouth-breathing, with its many consequent evils, results from these obstructions to the free passage of air through the nose. Mouth-breathing allows the entrance of dust and microbes directly to the

throat, larynx, trachea, and lungs; in breathing through the nose most of these particles lodge on the nasal mucous membrane and return to the outside as described before. The bronchi and trachea have ciliated epithelium like that in the nose, and although this epithelium, by means of its waving, hair-like processes, expels many of the minute foreign bodies that enter the lungs, nevertheless some reach the air-cells of the lungs, even under ordinary conditions in which breathing is carried on with the mouth closed; but mouth-breathing adds enormously to the number of bodies that reach the air-cells deep in the lungs. In this way the germs of tuberculosis, pneumonia, bronchitis, influenza, etc., enter the lungs much more readily than in nose-breathing. This is especially true of the quick and forcible breathing in violent exertion. Through the open mouth diphtheria germs reach the tonsils or larynx directly.

When one nostril is more or less closed permanently, as is common in adults, the sufferer has to try to breathe through the other nostril. The consequent rarefaction of the air in the nasal passages and in the pharynx by suction overfills the blood-vessels and disposes to catarrh. In singers nasal stoppage places undue strain on the voice in the effort to overcome the lack of resonance due to the obstruction of the nose.

Long-distance runners well know that their "breath" gives out very soon if mouth-breathing is used, while breathing through the nose soon results in what is called **"second wind,"** in which respiration becomes easy again. Second wind is partly due to a dilatation of the blood-vessels, lowering the blood-pressure and thus rendering the heart's action easier. It is also in part due to the fact that breathing through the comparatively narrow nasal orifices allows the air to enter the thorax less easily than through the mouth; the negative pressure within the chest is therefore greater, and so the thorax pumps blood as well as air in and out of its cavity, thus aiding the heart in its work. Thus, deep breathing through the nose during exertion tends to lessen the heart-strain of cycling, running, boxing, and other sports and exercises. A fairly safe rule is to limit the effort in running, cycling, etc., to what one can do without resorting to breathing through the mouth. Stop or go slower when you can no longer do with nose-breathing alone.

How absolutely indispensable to healthy throat and lungs is an unobstructed nose can not be too strongly emphasized.

Causes of Nasal Disease.—A healthy nose needs no use of sprays, nasal douches, and such like. In fact, the care of the nose involves

chiefly a knowledge of the predisposing causes of nasal disease, and the careful avoidance of these causes. There are, however, some nasal affections, such as malignant growths, bony tumors, etc., which are not preventable. Much can be done, however, to limit the occurrence of the ordinary catarrhal troubles of the nose which induce other morbid conditions, such as polypi or suppuration of the air-chambers or sinuses that open into the nose as described in the preceding pages.

First among the causes of catarrhal affections of the nose is **exposure to cold**, especially of those parts of the body ordinarily covered by clothing. This happens especially during high winds, or in chilly and damp weather, or as a result of wetting of one's garments, or from insufficient covering or accidental uncovering at night.

Prolonged exposure in moderate cold is much more dangerous than a short subjection of the body to a sudden cold shock. A cold douche or plunge is followed by vigorous contraction of the coats of the blood-vessels of the skin, driving the blood from the surface. But in prolonged exposure to a slight degree of cold there is no such reaction of the skin and so a large amount of blood is cooled slowly, or there is a much greater total loss of heat or chilling. This is especially true of those who have made themselves non-resistant and "soft" by too much clothing or by too close indoor life. Contraction of the vessels of the skin does not take place as readily in such persons as in hardy ones used to exposure and outdoor existence. Cold does not seem to cause nasal catarrh in very pure air, as is the experience in Arctic expeditions, and the congestion of the mucous membrane due to cold appears to need in addition microbic infection to produce the common "cold in the head."

To avoid catching cold one must make the body resistant to the action of cold. The cold shower-bath is of great value for this purpose. It may be used every morning or evening for one or two minutes. The water should be cold enough to cause a decided reaction with the appearance of "goose-flesh." Since the body-temperature and vigor are lowest in the morning, it is preferable for delicate people to take the shower bath in the evening. Over-heated rooms, over-eating and too much clothing are fruitful causes of colds and are to be avoided. The sleeping-room should not cool down slowly over night, but be properly cooled before bedtime.

The avoidance of nasal catarrh depends on the keeping of the body in the best physical condition. The nasal passages will then resist irritants that in lowered health they cannot withstand. This is especially so of the irritants that are inhaled, such as dust and germs,

which of themselves do not cause nasal catarrh in persons who are healthy.

The healthy nose can dispose of dust and microbes very well, yet when its mucous membrane is swollen and inflamed in catarrhal states it is susceptible to germ infection, so that in the last stages of acute catarrh of the nose (or what is known as a "cold in the head"), and in many chronic cases of the same affection, a purulent secretion occurs on account of pus-producing germs which are present in the nose.

The germs of diphtheria, tuberculosis, influenza and glanders, ordinary abscesses, and the contagion of measles and of scarlet fever are all apt to infect the nose, especially when a nasal catarrh has made ready the soil.

Fig. 101. Respirator or mouth and nose guard against dust. A piece of wet linen, cotton or handkerchief should be stretched over the guard.

Dust-inhalation can be avoided only partly, but the amount of dust in houses should be reduced to a minimum. The greatest dust-holder is carpet, but curtains and all drapery also hold large amounts. It is in sweeping and "dusting" that dust is scattered over the rooms and remains floating in the air for hours. The air of rooms contains many more microbes than even that of the city streets. Persons engaged in dusty occupations are told to use a **respirator**, but this is generally so disfiguring that few can be induced to wear one, so that there will be many victims of unhealthy respiratory conditions so long as employers do not supply pure and clear air in their establishments.

The dry air of heated houses in winter favors unhealthy conditions in the nose. The secretions become scanty, and the mucous membrane dry, preventing the removal of dust in the normal way or at all. The mucus forms adherent crusts which are liable to crack and be torn off, injuring the epithelial covering of the membrane,

and so opening the way to germ infection. The epithelium or layer of pavement cells resists the entrance of germs so long as it is uninjured. This is especially the case if a slight catarrhal condition is

Fig. 102. The hair hygrometer—to indicate the degree of moisture in the air. A long hair passes down and turns around an axle to which is attached a pointer that moves over the scale. The hair is kept taut by the weight below and as it lengthens or shortens, according to the amount of moisture, the pointer indicates the degree of saturation of the air. The screw above is to regulate it. A home-made one may be readily constructed.

already present. Erysipelas is sometimes set up in this way, the microbe entering the fissures and denuded areas in the nostrils.

It is quite as important to **supply moisture to the air of a house in winter** as to supply heat, and until architects appreciate this, most

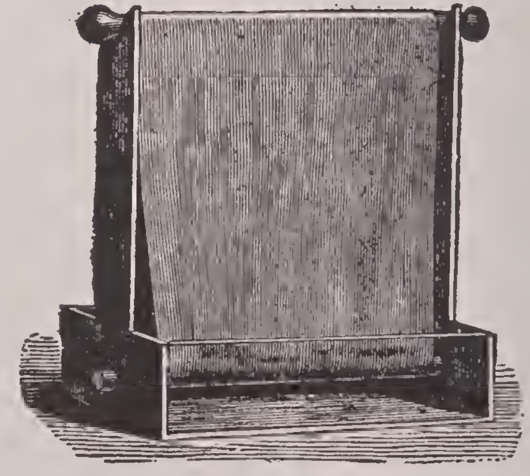


Fig. 103. A device to keep the air of a room moist. The box below is filled with water, into which dips the roller towel passing over the roller above. The towel should be rolled on once in a while.

people will suffer rather than use such troublesome measures as hanging moist cloths in front of the radiators, etc. Experiment shows that a room at 68° F. with 60 per cent as much moisture as the air will hold feels warmer and is much more comfortable and healthy than the same room at 72° F. with only 30 per cent of moisture.

An **atomizer** with a saturated solution of boric acid in water is a useful article in the care of the nose when the evils of dust-breathing and dry heating air exist. Its daily use will relieve the dry irritated state of the mucous membrane, and prevent nasal catarrh by removing the excess of dust.

Picking the nose is a very unhygienic as well as offensive habit. Most of the nose-bleeding in children is due to the injuries of the mucous membrane of the nasal septum with the finger-nail, causing small crusting ulcers. Removal of these crusts is apt to be followed by nose-bleed. The hair-follicles at the nasal entrance are also liable to be infected by the finger, and painful, unsightly boils result. Conditions which favor drying of the nasal secretions foster the habit of nose-picking in children. A few drops of vaselin applied within the nose on a brush or cotton swab will do much to prevent crusting, as all oils dissolve and loosen crusts.

Abscess and suppuration of the antrum of Highmore, the air-cavity in the upper jaw, may be due to decay of teeth whose roots project into the floor of the antrum. Care of the teeth is necessary to prevent this very distressing trouble. Some cases are due to nasal disease.

The Nasopharynx.

The space into which the nose opens behind is called the **nasopharynx.** Its roof is formed by a part of the base of the skull, its back wall by muscles covering the vertebræ of the neck, its lateral walls by ends of the Eustachian tubes, which lead from the nasopharynx to the ear and supply it with air. A deep recess, the fossa of Rosenmüller, lies back of the Eustachian tube and forms part of the lateral wall. The floor is formed by the soft palate, behind which there is an open space leading down into the oro-pharynx, or part of the pharynx into which the mouth-cavity opens. This is closed when the soft palate is made tense and raised. In children the greater part of the roof of the nasopharynx is covered by the third tonsil, or Luschka's tonsil. The far-reaching evils of enlargement of this tissue by **adenoid growth** have already been described as far as stoppage of respiration is concerned, but another important danger of this condition is pressure on the Eustachian tubes, with more or less closure of their opening, interfering with the ventilation of the middle ear—a very common cause of deafness in children (see further on in regard to deafness).

Habitual stopping up of the nose in children is therefore always

serious, as chronic deafness results from neglect of this condition. The best treatment of enlargement of the third tonsil is its removal by a simple operation. As it is a condition occurring in the hardiest and healthiest children, there seems to be no means of avoiding it. Enlargement of the third tonsil usually disappears in adults by atrophy, but not until the nasopharynx becomes the seat of more or less chronic catarrh.

Catarrhal states of the nasopharynx are due to the same causes as in the nose, and their prevention requires the measures already described for the latter. Catarrh of the nasopharynx should not be neglected, as it endangers the hearing by extension to the Eustachian tube and middle ear. Deafness is also tended to by nasal obstruction, as swallowing then causes a partial vacuum (or a lowered air-pressure) to form in the nasopharynx which sucks the air from the middle ear, drawing in the drum-membrane and its little chain of bones and stopping their vibratory motions, which occur in the transmission of sound from the air to the ear.

The Mouth-Pharynx.

Anatomy and Physiology.—Below the nasopharynx and continuing it downward is the **oropharynx,** or part of the pharynx into which the mouth opens and which is popularly termed the throat. It is directly visible through the mouth, while the nasopharynx is visible only by means of a small mirror and reflected light. The oropharynx is continuous with the cavity of the mouth, but is separated from it by the **isthmus of the fauces,** a narrow space enclosed at the sides by muscles which are continuous with the soft palate, and which form what are called the anterior and the posterior pillars of the fauces. Between these lie the palatine **tonsils,** also called faucial tonsils and known ordinarily as **the** tonsils. The back wall of the oropharynx is continuous with that of the nasopharynx, and lies in front of the vertebræ of the neck. Its anterior wall is formed by the root of the tongue. The oropharynx is used both for breathing and speaking and for swallowing. It is a part of the throat that is very resistant to disease, but the tonsils just in front of it are more susceptible to infections than is any other part of the body.

The tonsils may be enlarged by chronic hypertrophy (or overgrowth); they then obstruct respiration and injure the voice. Many tonsils that do not enlarge are subject to other recurring inflammation, due to repeated microbic invasion. An enlarged tonsil is very apt to be the seat of diphtheritic infection; it is therefore a constant

menace. The evil effects of enlarged tonsils on breathing and hearing are not nearly so great as in the case of the enlarged pharyngeal tonsil. Yet the palatine tonsils are often removed, as they are visible and easy of access, but the worst offender, the third tonsil, is left. In many the tonsils frequently become infected with pus, forming

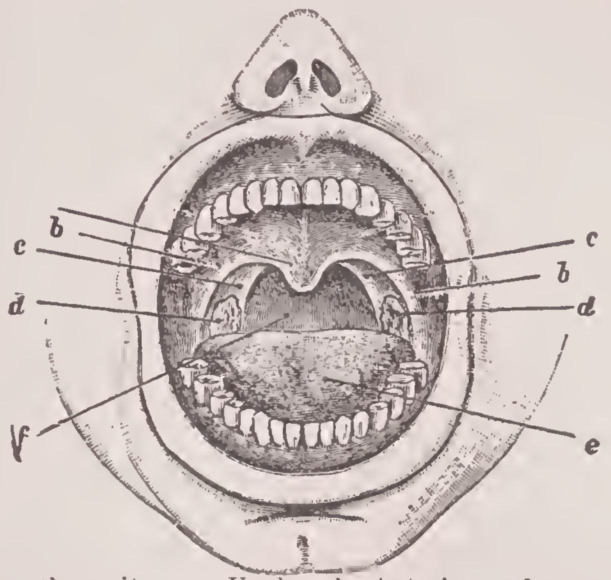


Fig. 104. The mouth cavity. a, Uvula. b, Anterior and c, posterior palatine arch (or pillar of the fauces). Between them is d, the tonsil. e, Tongue. f, Pharynx or throat.

germs, causing abscesses around them, a condition known as "quinsy." Children with enlarged tonsils often make a marked gain in weight and health after removal of the tonsils. In adults recurring abscesses (quinsy) or inflammation necessitates treatment and perhaps removal of the tonsils before proper hygiene of the throat is possible.

The Tongue.—The back of the tongue is often coated with thickened, decomposing epithelium, which may extend forward to the tip as visible **"coating of the tongue."** This coating on the back of the tongue is usually the cause of **bad breath** where there is no actual disease to give rise to it. Scraping off the coat with the ring of one handle of a pair of scissors as far back as one can reach removes this bad smelling material. That the base of the tongue is quite often the origin of bad breath is known to very few, and this offensive condition is commonly attributed to "catarrh." Coating of the tongue, whether due to disordered stomach or to some throat disorder, should receive medical treatment.

The laryngopharynx is the lowest division of the pharynx, and is situated behind the larynx, or voice-box. Below this it is continued downward as the esophagus, or gullet. This part of the throat is not

much subject to disease of a preventible nature, but it is a place where foreign bodies, fish-bones, and the like, often lodge, because it is narrowed in its lower part.

The Larynx, or Voice-Box.

The larynx lies in front of the lowest part of the pharynx. Its framework consists of several cartilages. The largest of these, the **thyroid cartilage,** forms the greater part of the front of the larynx, and is shaped somewhat like a shield. It forms a prominence on the front of the neck termed "Adam's apple," which is most evident in the male sex. Below and also extending up behind it is the **cricoid cartilage,** to which the thyroid is jointed and upon which it is freely movable. The cricoid is shaped like a signet ring, with the broad part of the ring behind. On the top of this broad posterior part are situated two small, very movable cartilages, the **arytenoid cartilages,** pyramidal in shape. The strong, band-like, white, fibrous structures,

Fig. 105. The position of the vocal cords in quiet breathing. A, Epiglottis (see Fig. 97). B, False vocal cord. C, True vocal cord. D, The ring-cartilages of the windpipe seen through the space between the true vocal cords.

Fig. 106. The position of the vocal cords in voice-production The space between the true cords is reduced to a narrow slit and the air is thrown into vibration (of sound) as it is forced through the space.

called the **vocal cords,** are stretched from the arytenoid cartilages behind to the thyroid cartilage in front and are also attached to the latter along their lateral edges. Their inner or medial edges are free or unattached and bound a slit-like opening, the **glottis.**

The larynx has many small **muscles.** Some of these move the cricoid backward from the thyroid cartilage in such a way as to make the vocal cords tense; others move the arytenoid cartilages so that the vocal cords are at the same time brought together. Air forced through the narrow slit thus formed between the vocal cords sets these in vibration like a violin string. Or, rather, it may be said the air is set vibrating as it passes between the tense vocal cords and sound or voice results. Other muscles move the arytenoid cartilages apart, so

that the space between the vocal cords, the glottis, opens for quiet breathing. If these last-mentioned muscles are paralyzed the vocal cords come together and cannot be separated, and there is danger of suffocation. There is a muscle imbedded in each vocal cord that regulates the tension of the latter and makes possible the wonderfully fine adjustments of the voice in regard to pitch.

By means of the **laryngoscopic mirror** the larynx may be examined. The most conspicuous structures to be seen are the vocal cords, which appear as two white glistening bands extending forward and back. They are wide apart behind and close together in front during quiet breathing, thus forming a triangular opening, through which a view down the trachea, or windpipe, may be had. When a vocal sound is made the vocal cords are seen to come together and touch each other by their inner edges. In front of and above the cords is the **epiglottis.** This is leaf-shaped and curves over the larynx. It probably helps to prevent food or drink from going into the larynx and so into the windpipe. At the posterior ends of the vocal cords can be seen two small roundish bodies. They move with the cords and are the arytenoid cartilages.

Functions of the Larynx.—By means of the laryngoscope it is seen that during inspiration the vocal cords move automatically apart, coming slightly together again during expiration. The larynx is, therefore, a respiratory opening for the passage of air to the lungs, for which purpose the vocal cords must be held apart by the proper muscles.

A second function of the larynx is to guard the air-passages below it from the entrance of foreign bodies. Even a small object entering the larynx causes at once a spasm (or rapid and strong contraction) of the vocal cords, that brings them together so closely that nothing can pass them. This spasm may last long enough to cause signs of suffocation with blueness of the face; even death may result by suffocation before the spasm ends.

The most important function, however, of the larynx is the **production of voice-sounds.** For this three things are necessary: The bellows, to furnish air under pressure, supplied by the lungs; the vibrating membranes, to set the air vibrating or sounding, the vocal cords; and the pipe, or trumpet, beyond them, supplied by the cavities of the upper part of the larynx itself, pharynx, nose, and mouth. For the production of sound the vocal cords must be brought near together and made tense by the laryngeal muscles. The higher the pitch of the sound to be produced the more tense are the vocal cords,

and the higher the larynx is raised in the pharynx, thus diminishing the length of the pipe, or tube, attached to the larynx, which has been likened to the part of a trumpet beyond the vibrating reed. For low-pitched sounds the larynx is lowered or descends, so that the trumpet is lengthened. This raising and lowering of the larynx makes the production of high or low tones easier, but is not absolutely necessary to sound-production, for by muscular effort the changes of pitch can be produced without change of the position of the larynx, the pitch being altered by a change in the length of the vocal cord, just as a violin-string is fingered to make a higher note. This muscular effort, however, is a severe strain for the voice. See under the hygiene of the singing voice. The up and down motions of the larynx can be tested by placing the finger on "Adam's apple" during the production of alternate low and high notes.

How Voice-Sounds Are Made.—While the **pitch** of the voice is mainly, therefore, controlled or determined by the vocal cords, its **timbre** (or quality) depends chiefly on the pharyngeal, nasal, and mouth-passages. It is possible to let the air pass through the mouth only during a vocal sound, the soft palate shutting off the naso-pharynx and the nose from the mouth; or the air may be allowed to go only through the nose, or it may go through both nose and mouth at the same time. Endless slight modifications of these conditions are possible, and the voluntary changes in the voice by alteration of the position of the soft palate, lips, tongue, or pharynx and its parts are innumerable.

The shape, size, and position of the air-spaces above the larynx so affect the quality of the sound that no two voices are exactly alike, and individuals can be readily recognized by their voices alone.

The oral, pharyngeal, and nasal passages above the larynx may be termed the attached tube. If the larynx is detached from this, as has been in cases of cut-throat, a feeble sound only can be made. This shows that the attached tube gives not only quality to the voice-sounds, but also intensity, acting similarly to a speaking-trumpet. The respiratory function of the larynx is interfered with only by disease severe enough to narrow the air-passages so much as to leave too small an opening for air to pass in sufficient volume.

Taking Care of the Voice.—A pleasing speech and voice are almost equal in importance to personal appearance. Numerous and complex movements are needed to produce speech, and these are acquired slowly and with difficulty. In fact, a center for these delicate movements has to be developed in the brain as the child grows. Speech is

largely dependent on imitation, and if the voices a child hears are harsh or coarse its, also, will be similar. **The best way, therefore, to teach a child distinct and refined speech is to let it hear such only.** However, this is not always all that is necessary. Enlarged tonsils and, still more, adenoid growths block the way of the sound-waves to the nasal cavities. The voice thus lacks both intensity and resonance, and the child has to adjust all its speech-muscles to the strain thus thrown upon them. This interferes with the acquisition of the delicate co-ordination (or working together) of the muscles necessary for distinct speech, and such children usually have imperfect articulation. Very many people thus grow up handicapped by hasty, slurred, harsh, disagreeable speech and voice. Parents seldom appreciate the advantage that a refined, melodious voice will be to their children in after-life.

Proper singing is one of the best ways of cultivating a pleasant speaking voice, even if the singer has taken only a place in a chorus. It is a delight to hear a good singer speak, and often we can tell that a person is a singer simply from the speech. **Improper** singing, however, is not only disagreeable to others, but soon ruins at least the singing voice.

Children should be allowed and encouraged to sing. It paves the way to singing in adult life, and as they are not self-conscious and are not spoiled by improper "systems" they do not strain their voice muscles, especially as the tunes they sing are within easy reach of their voices. It must first be insured that there are no obstructions, such as enlargement of either the faucial or the pharyngeal tonsils. Children with hoarseness due to laryngeal ailments cannot sing. An imperfect "ear" may be improved vastly by persistent efforts to sing true. When a child's voice is changing, at twelve to fifteen years of age, singing should be prohibited until the adult type of voice has been fully developed. This is true of girls as well as boys. Singing is splendid respiratory exercise, and tends to develop a full, well-formed chest, and so acts as a preventive of lung-diseases.

One of the commonest **causes of voice-deterioration** is imperfect general health. Persons, with weak muscles and little energy, cannot develop a good voice. The part put upon the greatest strain, the larynx, is subject to repeated catarrhs. Increased effort is necessary, and the strain of the muscles of the larynx soon results in loss of the singing voice.

A second prolific cause of loss of the singing voice is persistence **in singing during attacks of acute laryngitis** (inflammation of the

larynx, hoarseness), a persistence often resulting in the chronic form of the disease. There is thickening of the mucous membrane, hindering approximation of the cords, and causing the muscles to be used too energetically, so that their fine adjustment becomes quite disordered and the notes become untrue in pitch. During attacks of laryngitis the voice should have as nearly perfect rest as possible. Neither should a singer use his voice during "cold in the head," as the obstruction caused by the swollen mucous membrane of the nose disturbs the muscular actions ordinarily used.

Another cause of voice-injury in singers is **improper method in singing.** As with other muscles, those of the larynx under excessive action become strong and slow, while delicate adjustments are lost. They become, as gymnasts say, "muscle-bound." All improper modes of singing cause needless strain of the voice-muscles.

A very harmful fault is a rigid position of the larynx, its up and down motion being inhibited, resulting in a **"throat voice."** Tense contraction of muscles that should be relaxed is involved in this way of speaking or singing and the muscles work under great disadvantage. That this imperfect and unnatural method of singing with restraint of the normal up and down motions of the larynx is a part of a "method" taught by some vocal teachers is almost incredible, yet only too true. A disagreeable **tremolo** results from singing **forte** under these conditions, and an objectionable forced or pressed sound of the voice also results. Another of the evil effects of this strained way of singing is chronic laryngitis with thickening and irregularities of the vocal cords. This is true of all improper and strained modes of using the voice, though the larynx varies in its power of withstanding abuse. A voice used out of its normal register, especially if constantly straining after high notes, will soon give out. Singing-teachers make great mistakes in yielding to the ambitions of pupils, or in not being careful in determining the normal voice for each pupil, allowing altos to attempt to be sopranos, and baritones to be tenors, etc.

Over-use of the voice endangers it; also trying to sing difficult music before the voice is sufficiently trained. The laryngeal muscles differ from many others in that they are continually and with great exactness adjusting the position and tension of the vocal cords, and holding them in certain positions. This great amount of use renders them especially liable to injuries after prolonged fatiguing efforts. To sing well and long, careful practice is needed so that little by little the muscles acquire their exact adjustments. It is a matter rather

of developing and fixing paths in the central nervous system, by which the muscles are controlled. By improper use of the voice it may become irretrievably injured and even actual disease of the larynx may result. No one should sing until the voice is fatigued, but by easy stages the voice-muscles may be used longer until they acquire endurance.

Many persons in speaking or singing begin the vocal sound with sudden emphasis. In this the vocal cords come together with spasmodic force, which not only produces a disagreeable vocal sound, but irritates the free borders of the cords, resulting in the formation of small prominences, called **singers' nodes**, which greatly lessen the clearness of the voice. This spasmodic action of the vocal cords is called the "coup de glotte."

Strong, robust people with good natural voices sometimes try by sheer muscular effort to overcome their lack of vocal education. As these have not learned to use their laryngeal muscles in proper united action, a disagreeable tremolo results. Persons who have weak physique or imperfect development should strengthen themselves by calisthenics and breathing-exercises before attempting to sing. The body must be well nourished. Anyone who has lost much weight or who has not fully recovered from an exhausting illness should not sing. The modern "forced feeding," in which the patient limits his daily amount of food not by his appetite, but by his digestive powers, is of great value here. Many thin individuals suffer from self-imposed starvation, as their appetites fail from nervous causes and hunger is lost, while the digestive powers are unimpaired. Feeding to the limit of the digestive powers would restore the health of such. Tight garments, especially corsets, should not be worn, as they interfere with chest-expansion, holding prolonged notes, and with the regulation of the air-current necessary in singing.

How to use the vocal organs in singing is, of course, best left to singing-teachers; but as these are not all competent, an attempt has been here made to furnish some useful knowledge to those who desire to sing, knowledge which will help them to tell whether they are in good hands or not when they begin to take singing-lessons.

THE CHEST AND LUNGS.

The wall of the thorax encloses the chest-cavity; it is formed by the ribs, the costal cartilages, the sternum, and part of the spinal column. The latter is the fixed base to which the other movable parts of the chest-wall are attached. Twelve ribs are attached on each side

to the twelve dorsal vertebræ, their heads forming joints with the bodies of the vertebræ, while their necks rest on the strong transverse processes of the vertebræ, moving upon them and being attached to them by another joint at the tip of the transverse process. The ribs are joined in front to the costal cartilages, which are really elastic, cartilaginous prolongations of the ribs. The costal cartilages of the first seven ribs join the breast-bone directly; those of the eighth, ninth and tenth ribs are each joined to the costal cartilages above; while those of the eleventh and twelfth are unattached and hence these two ribs are called the "floating ribs."

The breast-bone, or sternum, lies in the middle line in front. It moves with the ribs, forming with them a cage with movable walls enclosing the lungs.

The muscles of the thorax are the **intercostals** that fill the spaces between the ribs and complete the chest-walls; the **diaphragm** (or **midriff**), which closes the cavity of the chest below, separating it from the abdomen; and the accessory or extra respiratory muscles (muscles of forced breathing), not in use during quiet breathing. These auxiliary muscles for **forced inspiration** are: 1. The **scaleni,** arising from the vertebræ in the neck and inserted into the first and second ribs; 2. the **sterno-cleido-mastoid** muscles, arising from the skull behind the ear and attached to the clavicle, or collar-bone, and to the sternum; 3. the **pectoralis minor,** arising from the scapula, or shoulder-blade, and inserted into the third and fourth ribs; and 4. the **serratus posterior superior** muscle, arising from the spinal column and attached to the ribs behind; and 5. the long and the short elevator muscles of the ribs.

The muscles that are used for **forced expiration** are the abdominal muscles, forming the walls of the abdomen; the **serratus posterior inferior,** attached to the spine below and reaching up to the lower ribs, and the **quadratus lumborum** muscle, which takes its fixed point from the pelvis and pulls the ribs downward.

The only muscles in use during normal quiet breathing are the intercostal muscles, the diaphragm, and the long and the short elevators of the ribs. These are all muscles of inspiration. Ordinary expiration requires no muscular effort at all, as the weight of the thoracic walls and the elasticity of the lungs give sufficient power to expel the air, the ribs and sternum, dropping down into the position of finished expiration by their own weight.

The lungs are composed of an immense number of little air-cells, or **alveoli,** which communicate with the outer air by means of the

bronchial tubes. These latter begin as minute tubes, which unite to form larger and larger ones, finally entering the windpipe, or trachea, by means of a large **bronchus,** for each lung. The walls of the larger bronchial tubes are stiffened with rings of cartilage; and the walls of the smaller ones down to diameter of 1-25 inch have cartilaginous plates. The bronchial tubes have a layer of muscle-fiber placed circularly, also a lining mucous membrane of which the full surface has a ciliated stratified epithelium. The air-cells, or alveoli, are lined with thin pavement-like epithelium and have a dense network of capillary blood-vessels in their walls. (See also Part I on the Respiratory System.)

The function of the air-cells is to allow the blood to absorb oxygen from the air and to give up carbon dioxid. The lung is therefore a gland designed to change the composition of the blood by altering its gaseous constituents. The red blood-cells do not simply absorb the oxygen of the air, but take it into loose chemical combination with their coloring matter, the **hemoglobin,** to form so-called **oxyhemoglobin.** This in turn gives up the oxygen to the tissues of the body. The blood entering the capillaries of the air-cells comes from the right ventricle of the heart via the pulmonary artery and is venous blood. It leaves the capillaries of the air cells via the pulmonary veins. In the blood-capillaries of the walls of the air-cells it has been oxygenated or changed to arterial blood, or blood which has taken up oxygen. The lungs have a further blood-supply for their own nutrition, as that which passes through the capillaries of the pulmonary artery does not nourish the lung itself, but is merely carried through for the purpose of oxidation. The arteries supplying the lungs with nutrient blood are called the **bronchial arteries;** they contain arterial blood and are branches of the aorta.

The walls of the alveoli of the bronchial tubes and of the tissue between the lobules, or clusters of air-cells, at the end of a bronchiole (or minute bronchus) are largely composed of **elastic fibers.** This gives the lung its rubber-like elastic power of contraction after expansion.

The lungs are not attached to the chest-wall, but are covered by a smooth glistening membrane called the **pleura.** A similar membrane lines the inside of the chest-wall and is termed the **parietal pleura,** while that on the lung is the **visceral pleura.** The lungs are in contact with the chest-wall but are not attached to it, and the layer of the pleura covering the lung, while in touch with that lining the chest-wall, nevertheless glides smoothly upon it as the lung expands

and contracts in respiration. If an opening be made in the chest-wall the lung collapses by reason of its own elastic retractility, and air rushes into the **pleural cavity** between the visceral and the parietal pleura. In health, of course, there is no pleural cavity, as these layers of pleura lie everywhere against each other.

The lungs are kept expanded by the fact that the chest-wall keeps the air-pressure off the outside of the lungs while the air-pressure acts on the interior of the lungs, through the air-passages which lead from the outside to the inside. This may be termed the "suction" of the chest-wall. In health the lungs never entirely collapse. The inspiratory muscles lift the ribs upward and outward, thus increasing the circumference of the chest, while the diaphragm descends, increasing the vertical dimension of the chest. This increase in the size of the chest causes lowering of the pressure in the chest; consequently air rushes in through the open air-passages (nose, mouth if open, pharynx, larynx, windpipe) and distends the lung. At the same time, **blood** rushes into the chest through the large veins that enter it.

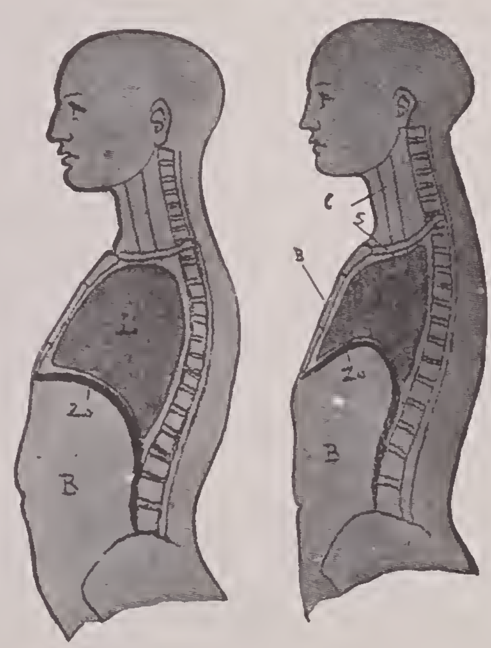


Fig. 107. The diaphragm or midriff, Zw, in inspiration (first figure), and in expiration (second figure). L, Lung. B, Abdomen. Note that its front wall bulges forward in natural inspiration. B, Breastbone. S, Collarbone. c, Windpipe.

Ordinary expiration takes place by the retractile power of the lung and by the weight of the chest-walls, no muscular effort being needed, only relaxation of the muscles that enlarged the thoracic cavity in inspiration. In consequence the pressure within the chest rises and air is forced out through the air-passages, while blood also is forced out through the arteries.

The narrower the orifice through which the air passes into and out of the thorax the more the blood is forced in and out, so that nose-breathing is more of an aid to the circulation of blood in the

thorax than mouth-breathing is. The thorax loses much of its mobility and expanding power in advanced life, and in the aged it becomes stiff and rigid. The motion of the ribs in their sockets becomes lessened, and the elastic costal cartilages, which are twisted during each inspiration, normally become calcified or limy and too stiff to yield to

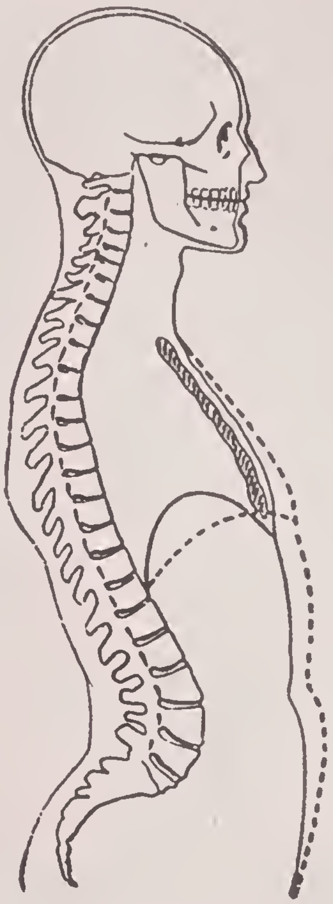


Fig. 108. Diagram showing the change in the position of the diaphragm and of the front of the body in breathing. The dotted lines indicate the position in *inspiration* (i. e., after breathing in).

the inspiratory pull of the muscles. The air-cells (and so the whole lung) become permanently enlarged in age and the lung's range of expansion is lessened. In other words, old people can not take in as big a breath as younger. Age therefore disqualifies for violent exertion, and breathlessness comes sooner during exertion in age than in youth. By gymnastics and respiratory exercises practised through life the greater part of the mobility of the thorax can be maintained till a very advanced age. Gymnastics are, therefore, always helpful.

Deformities of the Thorax.—A well-formed thorax is essential to a good power of keeping the blood pure; yet the thorax is more often deformed than any other part of the body, a fact which accounts in part for the great frequency of lung-diseases.

The chest may be regarded as simply an air-pump. If its capacity or its movements are diminished in any way it can obviously handle less air than is necessary.

In the extreme chest-deformity seen in **hunchbacks** there may be portions of the lung entirely unexpanded, forming simply a solid fleshy mass. In a less degree the commoner deformities of the chest prevent the proper expansion of the lungs, especially within the parts most deformed.

The most common chest-deformity is **scoliosis, or lateral curvature of the spine,** in which there is also twisting of the spinal column to one or the other side, usually the right In this deformity one shoulder is lower than the other, and the relatives and teachers of the child tell him to "lift his shoulder" and "stand straight," thinking that the deformity is in the shoulders. In scoliosis the side of the thorax toward which the spine is twisted is compressed. There is ordinarily another spinal deformity associated with scoliosis, namely, **kyphosis,** or bending of the spinal column forward, in which the thorax is rounded behind and flattened in front—the typical, flat-chested, round-shouldered person, a frequent product of our schools. Even the laity know from sad experience that children with this form of chest are prone to consumption.

The kypho-scoliotic thorax (in which the spinal column is curved to the front and also to one side) has deficient expansion, especially

Fig. 109. Faulty position in writing or in sitting at a school desk. It causes lateral curvature of the spine (so-called *scoliosis*).

of the apex of one lung, making it very liable to tuberculous infection. This deformity originates chiefly in school, as a result of fatigue of the muscles which keep the spinal column erect. As these muscles relax from weariness due to long sitting at the desk the spinal column bends forward and rotates toward one or the other side. If this is repeated often and continues for hours at a time the growing bones become permanently misshapen from compression, and deformity

results which is permanent. Kyphosis, however, may exist without scoliosis.

For the prevention of spinal deformities it is necessary, in the first place, to have seats that permit a child to rest the muscles that keep his spine in the proper position of erectness. If possible, the plane of the book's surface should be almost parallel to the plane of the child's face (i. e., almost vertical), so that he can read while sitting erect and without bending over his desk. This, however, would require special devices for holding the books at the proper height and angle.

Calisthenic exercises which give vigor to those muscles that are involved in the evil of prolonged sitting should be given every half-hour, and be continued for five minutes at a time. The muscles that hold the spine erect and that give it side support are the ones that need to be especially strengthened in this way. Deformity always results when muscular support is removed from any part of the skeleton under strain, as the ligaments that unite the bones stretch under strain, for they simply **limit excessive motion**, and do not support the skeleton as the muscles do. The spinal muscles are quite independent of those holding the shoulders. For round-shouldered persons to draw their shoulders back is not enough; this alone will not straighten their backs. The shoulders are only secondarily displaced in spinal deformity, having little to do with an erect attitude. The spinal muscles, chiefly those that keep the back straight, should be exercised while the shoulders are loose and in a state of relaxation.

"Shoulder-braces" are absolutely worthless, and not only do not take the place of the muscles in holding the spine erect, but hasten the wasting and weakening of these muscles and make their wearer stiff and ungainly in his motions. Even after growth is attained much can still be done partly to overcome those spinal deformities which have been neglected during growth. In overcoming scoliosis rotary motions of the spine (i. e., turning the body at the waist) in a direction opposite to its faulty twist are necessary to strengthen the muscles that should keep the body straight. Properly directed massage is of great value in correcting all forms of spinal deformity due to weakened muscles or wrong attitudes of the body in sitting or standing.

The tendency to a narrow form of chest, deficient in range of expansion and too small in capacity, should be counteracted in growing years by special attention to light exercises, such as sparring, running, etc., that call for deep breathing. Bicycling is of special value here, but the proper attitude in riding must be attended to care-

fully. See the directions in this regard. In adults, the bony frame of the chest is unalterable and the number of air-cells in the lungs is fixed, yet proper exercises will cause the limited movements of the ribs in their joints to increase, making the chest larger in full inspiration, when air-cells heretofore only half expanded become fully so. The chest becomes more roomy because of the greater motility of its parts, not because there is any increase in their size. Increased "chest-measurement" is due to two things only: 1. Change in the position of the ribs, which are more raised; 2. increase in size of the muscles of the chest-wall.

The flat and narrow chest with narrow intercostal spaces predisposes to consumption of the lungs. This is recognized in the term applied to this form which is called the **"phthisical thorax."** Pulmonary tuberculosis is much less common in persons with well-formed chests, as in them all parts of the lungs are expanded and kept healthy by use; while in the flat, narrow chest the upper parts, or apices, of the lungs expand but little, and these portions are especially liable to tuberculous infection.

Breathing pure air is next to a well-formed chest in importance to the health of the lungs. Proper breathing through a healthy nose tends to make the air dust-free before it reaches the finer bronchial tubes and the air-cells, but in spite of the many natural safeguards some **dust penetrates the air-cells.** The upper air-passages arrest most of the dust, and the bronchial tubes, branching at angles, catch much that remains before it enters the finer bronchioles and air-cells. The dust so caught is returned to the outer world again by the ciliated epithelium of the mucous lining of the bronchi. Much dust irritates the larynx and trachea, and causes coughing-fits which expel the offending particles. Only when the secretions are too abundant is coughing needful to keep the lungs clear of mucus or "phlegm." The dust which reaches the air-cells is taken up by the white blood-cells and carried in the lymphatic channels to the bronchial lymph-glands, where the dust is deposited. Microbes that reach the air-cells are carried off in the same way, and are apt to cause inflammation and abscess of the bronchial glands. This occurs so rarely, and these glands endure such large amounts of dust, that they may be regarded as very excellent safeguards to the lungs.

Organic dust, such as coal-dust and vegetable-dust, are the less harmful to the lungs than the dust of metals and minerals, which if inhaled long enough, cause "fibroid phthisis," a form of consumption which is slow in its progress and in which much fibrous tissue forms

in the lungs. How to avoid dust-breathing has been considered already under nasal hygiene.

Disease-producing microbes are being constantly inhaled; but only when resistance to them is lowered owing to impaired vitality or local disease in the lung are they liable to gain a foothold. The **diplococcus of pneumonia,** for instance, which is present in the mouths of many people and is often inhaled, is apt to cause pneumonia only if the person who inhales it has had a severe chilling or is already in poor health, or is enfeebled with age.

The influenza bacillus seems capable of causing disease in almost all persons, irrespective of their state of health; but the disease varies greatly in severity, the aged especially being liable to the dangerous forms of influenza in which the lungs are attacked, much the same as in pneumonia.

The bacillus of tuberculosis, which is doubtless often inhaled into our lungs, will cause pulmonary tuberculosis, phthisis, or consumption of the lungs, if one's health is not at a high standard. Again, there may be a special deficiency of the power of resistance to tubercular disease in some individuals which makes them particularly liable to be attacked by the microbe even when in good health. This predisposition to tuberculosis occurs in certain varieties of animals, the carnivores or meat-eaters, as a rule, being less liable to tuberculosis than the herbivors or grass-eaters, more especially the ruminants or cud-chewers.

How to Avoid Tuberculosis.—It is impossible to avoid breathing in the germs of disease into the lungs at some time, but the frequency and amount may be diminished by care on the part of consumptives. The **sputum, or expectoration, of consumptives** should always be deposited in fluid and never allowed to dry. If the sputum dries on the floor or in handkerchiefs, it will be pulverized and float about as dust. Thus inhaled, it spreads tuberculosis. The sputum, therefore, should be caught in a vessel containing fluid which dissolves the tough mucus, the best being a solution of lye. A stronger disinfectant, such as 5 per cent aqueous solution of carbolic acid, may be used. In spite of care, sputum may lodge on the edge of the vessel, so that this should be protected from flies, as they carry the bacilli about and infect food or wounds on which they light. Patients who go out of doors should carry cloths to cough into, or a paper-bag which must be burnt with the cloths. Of course, most patients will deposit their sputum on the street, not heeding the danger to which they subject the public. Fortunately, sunlight and the open air soon kill bacilli

deposited out of doors. Patients in the last stages of the disease, too weak to use a sputum-cup, should have a large pan into which they can drop the cloths used to catch their sputum. These cloths are, of course, to be burned before they dry. It is especially these patients who are near death that spread the disease, as precautions are then little observed by either patient or attendants.

The patients should take these precautions for their own sake, as they are apt to infect healthy parts of their own lungs or larynx by inhaling bacilli from their own sputum. A room in which a tuberculous patient has lived should be repeatedly and thoroughly disinfected with formalin (see Disinfecting).

It has been claimed that in coughing and even in speaking, tuberculous patients project into the air minute particles of saliva containing tubercle bacilli. During coughing this probably occurs to a slight degree at times; but this source of tuberculous infection is very unusual and does not justify compelling consumptives to wear cloth masks. During coughing, however, a cloth (or soft paper handkerchief) should always be held in front of the mouth.

The sputum of patients with influenza, pneumonia, or bronchitis should be disposed of in the same manner as that of tuberculous patients, as it also contains dangerous disease germs.

The health of the lungs depends on the **maintenance of a high standard of bodily health.** The lungs become especially vulnerable to the agencies of local disease on account of poor nourishment. Children of the poorer class, having poor food and living in badly ventilated rooms, are very liable to pulmonary and bronchial affections. (See also special article on Tuberculosis.)

Natural immunity prevents tuberculosis in many whose ill-health would otherwise render them victims; but those who have even a strong hereditary predisposition to the disease can avoid it by maintaining rigidly robust health. On the other hand, many have their natural immunity destroyed by depressing causes, especially by **alcoholism** and by diabetes. Habitual drinkers have a lack of resistance to tuberculosis even while their appearance remains robust and their weight normal. Excessive use of alcohol seems to antagonize natural immunity to the disease. The depression of vitality which comes on with advancing age, however, is accompanied by the formation of fibrous tissue and probably greater power of resistance to consumption, and when the disease occurs in elderly people it is likely to be in a slow and relatively benign form.

The physical training of a youth predisposed to tuberculosis should

receive as much care as his mental development. Every observer sees children well developed mentally who are in greatest need of careful physical training for their feeble, light-boned, flat-chested bodies; bodies that will be a perpetual hindrance to success or even effort, and which will cause premature ageing and invalidism. It is during the growing period, from twelve to twenty-four years of age, that physical training is of most avail, and it is strange that parents care so little about this greatest and surest promoter of the health and beauty of their children. Though some remarkable minds have been housed in feeble bodies, ordinarily these minds are of the receptive order, which take in facts readily but have not the power to elaborate or apply them.

The heart and lungs are intimately associated in action. Proper development of the muscles of the body implies not only a well developed set of respiratory muscles to ensure a good supply of oxygen to the blood, but also a strong and enduring heart to carry on a right circulation of the blood. The function of respiration is a great aid to the heart in carrying on the circulation, each inspiration and expiration forcing blood as well as air respectively into and out of the chest. A well-developed thorax, with good expansion, is therefore a great aid to the heart in its work.

Exercises requiring increased breathing should be performed with deep inspiration and expiration **through the nose.** The expiration especially should be watched, as the tendency is to keep the lungs full of air without emptying them properly and regularly, so that many athletes suffer from acute **emphysema** (dilatation, or overstretching of the lungs). All exercises involving slow powerful contractions of many muscles, such as lifting great weights, wrestling, part of the work done on the horizontal or parallel bars, tend to develop powerful, large, but slowly-acting muscles, and cause a strain on the heart, because respiration during these acts is either suspended or limited while the thorax is held rigid and the circulation of the blood through the thorax is much impeded. The chief cause of **acute heart-strain** or dilatation of the heart is sudden, great muscular effort. These exercises are to be avoided or practiced only in moderation, and only by the robust. They are certainly of little use in developing the thorax, as the respiratory excursions are too limited during the great efforts involved.

Another class of exercises tending to one-sided muscular development and physical strain are those which call for **prolonged muscular efforts,** such as long-distance cycling, rowing, or running. In modera-

tion these are all of benefit, but the tendency to overdo them is great. Of the three mentioned, running is by far the best, as the thorax is not held rigid as a base for the attached muscles, but is free and unrestrained in its motions. Running, when properly practiced, is one of the best of all exercises. In riding the bicycle it is highly important that the breathing should be deep, full, and through the nose only. If the speed is not so great as to necessitate breathing through the mouth, it will not cause over-exertion unless the ride be too long. It is especially in this form of exercise that heart-strain is likely to occur, largely because the thorax is held rigid and the breathing is apt to be shallow. A heart which has once been strained and dilated by imprudent over-exertion may apparently regain its vigor, but it is usually liable to a recurrence of the dilatation (or relaxation of its muscular walls, due to over-stretching) on moderate exertion, and so remains a weak organ.

The best exercises to develop an enduring and robust body are general calisthenics or the "army setting-up drill." Sparring, vaulting, hand-ball, and all work of this light, quick class are good. Swimming also is a fine respiratory and free-motion exercise. In fact, **all those exercises having unrestrained and easy motions are preferable to feats of strength or endurance.** Thus, putting the shot and lifting heavy weights are apt to do more injury than good. No exercise should be continued until it causes a physical strain. As with eating, it is a good rule to stop before you have to and while you feel that you can go on yet some time. Although the two may be easily and profitably combined, sport is not physical culture, for the latter is not to be pursued for amusement, but as a serious duty to one's self and others. No one should neglect his bodily vigor, nor allow it to diminish.

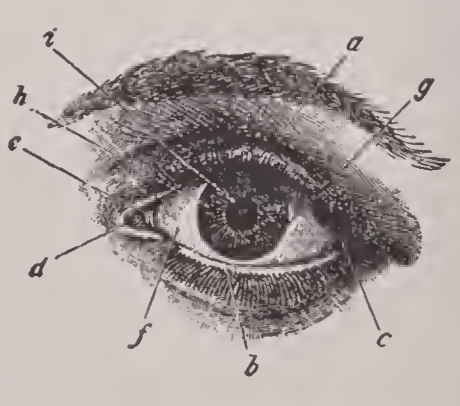


Fig. 110. The left eye. *a*, Upper, and *b*, lower eyelid and eyelashes. *c*, Outer angle of the eye. *d*, Inner angle and caruncle (fleshy, red little mass). *e*, Semilunar fold, a third eyelid which is much larger in the lower animals. *f*, White of the eye. *g*, Cornea or clear, horny front. *h*, Iris or rainbow curtain, in which is *i*, the pupil or central hole.

The Eye
Its Use and Abuse

Its Construction and General Care.

Relation of the Eyes to General Health.

Your Sight Is Your Most Precious Gift. Weak Eye-Sight Means Weak Power of Observation, Eye-Strain, Eye Disease, and Untold Inconvenience.

Subject Reference

For the Eye as Organ of Sense, see Vol. 1, pages 69-72.

For Removal of Foreign Bodies from the Eye, page 233.

For Effect of Eye-Glasses on Health and Selection of Glasses, see Vol. 1, pages 267-278.

For Children's Eye-troubles, see Vol. 1, pages 640-642.

Also see Vol. 2, pages 153 and 629.

One eye alone can not estimate size, depth, distance, direction, and motion as well as two. This is simply because the two eyes give us two different views at once. The value of this is readily appreciated by examining stereoscopic views with one eye alone and then with the two. Moreover, the field of vision of one eye is limited on the inner side by the nose and it also is deficient in the "blind spot."

The eyeball is a sphere, on the anterior surface of which is placed a segment of a smaller sphere. This latter is transparent and firm and is termed the **cornea,** because of its resemblance to horn. The **average diameter** of the eyeball is one inch. It is a trifle longer from front to back than vertically. It lies in a conical cavity, the **orbit,** formed by the bones, and is supported by a cushion of fat and other tissues. It is surrounded by a thin membranous sac, the **capsule of Tenon,** and is held in place by the eyelids and by its membranes and muscles. Except in front, the eyeball is well protected by the bony orbit. It is protected from jars by the tissue and fat about it. The latter is so important in relation to the eyeball that it is said to be the last to disappear in emaciation from disease or starvation.

The eyeball does not differ in size in different people except in proportion to the size of the body, but the form of the skull varies greatly in different individuals and race; and according as the orbit is deep set with overhanging ridges of the frontal bone, or is more open, there is a different amount of bony protection afforded the eyeball and a varying amount of the eyeball exposed to view. The latter depends also on the size of the eyelids and on the size and shape of the opening between these. Some eyes are very deep set in the skull,

while others are quite protruding and more liable to injury. Anteriorly the eyeball is protected by the eyebrows and eyelashes, as well as by the eyelids.

The eyebrows are stiff hairs in thickened skin, which rests over a bony ridge in the front of the skull above the margin of the orbit. They are absent in the lower animals. The eyebrows are to protect the eye from dust and perspiration, and to some extent to give shade to the eye. They have a marked influence on facial expression, and many emotions are partly expressed by their movements and positions. In some persons the eyebrows are very scant; in fair women they are sometimes very delicate, while in others, for instance swarthy men, they are long, thick, and bushy, giving a ferocious appearance, especially when unkempt. There is a tendency for the hair of the eyebrows to become coarser in advancing age.

Dropping out of the hairs of the eyebrows and other defects may be treated in the same manner as hair-defects elsewhere. The eyebrows should be kept neat and trim, just as the hair is.

The eyelids, or palpebræ, are composed of thin, loose skin, elastic tissue, the palpebral muscle, plates called the tarsal "cartilages," which give the lids shape and firmness, and the imbedded roots of the eyelashes together with the glands of the eyelids. These glands are of two kinds, viz., 1. the glands of Moll, which are like large sweat glands opening into the follicles of the eyelashes, and 2. the Meibomian glands, which are sebaceous glands that open just behind the eyelashes and by their secretion both prevent the eyelids from sticking together and keep the tears from running out on the cheek, unless very abundant.

The palpebral muscle encircles the eye-slit and closes it by bringing the eyelids together. It also can compress the eyeball when forcibly contracted. The upper lid is the larger and is movable, the lower lid is less freely movable, moving most in up and down motions of the eyeball. There is no fat in the eyelids; if this were not the case they might become closed by their weight in extreme obesity. However, the loose tissue of the lids swells very easily, and after blows or in inflammatory conditions, such as erysipelas, the lids sometimes are so swollen as to be entirely closed. The ordinary **"black eye"** is due to the escape of blood into the loose tissues of the lid, from which it is slow in being absorbed. Cold in the form of iced compresses or simply cold water is excellent if used soon after the blow, to prevent further exudation, while in the later stages hot compresses are good to promote absorption of the blood. There is no virtue in a poultice

except the continued heat, and local treatment of the black eye is of little value. Gentle massage helps to remove the blood to which the color is due. For cosmetic effect a bruised lid may be painted flesh color.

The delicate eyelid enables the physician to estimate the general circulation from its appearance. A dark hue of the skin of the lids, the so-called "rings around the eyes," is indicative of a sluggish circulation or of changes in the quality of the blood. Puffiness or swelling of the lids, popularly known as "bags under the eyes," is sometimes an early sign of disease of the heart or kidney.

The lids are lined with a very smooth membrane, called the **conjunctiva.** They move freely and with very little friction on account of the smoothness of their inner surface and of the outer surface of the eyeball, and the lubrication by the tears and the mucus (or slime) secreted by the conjunctiva.

An important function of the lids is to distribute the tears over the front of the eyeball, and by incessant winking to remove dust and keep the front of the eyeball moist. In winking the lids also act as a pump in forcing the tears through the tear-duct into the nose. Some rest for the retina is probably also obtained in the brief time of ordinary winking, but this is of minor importance. When the eyelids are paralyzed or when on account of protrusion of the eyeball they cannot be closed, the front of the eyeball, or cornea, quickly loses its lustre and transparency. Unless the use of the eyelids is speedily restored blindness will ensue.

The protective function of the eyelids against light or solid objects is very evident, and is so automatic as to be instinctive, and the lids close reflexly on the rapid approach of a foreign body or at a threatened blow.

The opening between the lids is called the **slit of the eyelids,** or popularly the eye-slit or palpebral opening, and on the length and breadth of this depends the "size" of the eye. A "large eye" or a small eye refers to the size of the palpebral opening and not to the actual size of the eyeball. There is little difference in the actual size of healthy eyeballs of different people, except, of course, relative to the different ages, the child naturally having a smaller eyeball than the adult. However, in some persons the large size of the pupil gives to the eye an appearance of greater size. Racial characteristics are seen in the size and shape of the eye-slit, as is shown in the almond eye of the Mongolian. The shape of the opening has a marked influence upon the expression and upon the beauty of the face. Actresses

prolong the shadow of the eye-slit and produce the impression of large eyes. A villainous expression is made by pencilling the outer angles upward. A drooping and partially closed lid is indicative of languor, and it is also used by artists to portray fatigue and voluptuous passion. In the final stages of wasting diseases the half-closed eye is a sign of impending death.

The eyelashes, or cilia, are seated in the lid border, and differ from the hairs elsewhere by their finer texture and in being thicker in the middle than at the ends. They are curved, those of the upper lid turning upward, while those of the lower lid curve downward. When the lids are partially closed the eyelashes interlace about the middle of the free part (or shaft) of each hair, forming a screen against wind, dust, or excessive light, while still allowing the entrance of light and therefore vision. The lashes are constantly falling out and being renewed, but this should not be noticeable.

In the inflamed condition of the lid-border, known as **blepharitis,** the eyelashes may fall out and become very sparse. If the inflammation is allowed to go untreated, a permanent **"blear eye"** results; the new lashes are stiff and may be misdirected, turning in toward the eyeball instead of outward. These ill-placed lashes are popularly known as **"wild hairs,"** and cause continual irritation and great discomfort by constantly rubbing against the sensitive cornea. Such misplaced eyelashes must be pulled out as soon as they are large enough to catch, or the bulbs must be permanently destroyed by electricity; in some cases even an operation on the lids is necessary.

Inflammation of the lid-edges with consequent distortion of the lashes results in an unsightly blemish, and if not properly treated grows progressively worse. In many cases it is one of the many results of congestion of the eye, due to uncorrected defect of the eye, and can be relieved only by proper glasses. Salves and ointments may alleviate but will not cure such cases. In other cases blepharitis is a part of a general skin disease, and will yield only to general medicinal and dietetic treatment by a competent physician. Sometimes it is due to the presence of tiny insects at the roots of the lashes, as in pediculosis (lice) or scabies (itch). In some cases the lashes in common with the hair elsewhere requires a stimulating or irritant treatment.

The lacrimal or tear apparatus consists of (1) **the lacrimal gland,** which secretes the tears; it is situated at the upper outer angle of the orbit and is connected to the space between the upper eyelid and the eyeball by (2) **eight to twelve small ducts,** which open by a series of

pores about 1-20 of an inch apart, a little beyond the junction of the upper lid with the eyeball. The tears are discharged from the gland into this conjunctival sac and spread over the front of the eyeball, collecting at the inner corner of the eye-slit in a space known as the "lake of tears." Into this "lake" dips a projection from each eyelid, on the summit of which is a small opening, the **punctum lacrimalis,** or lacrimal point. This is the mouth of (3) a small passage, the **lacrimal canaliculus.** There is a canaliculus in the upper end, another in the lower lid, and the two lead to (4) the **lacrimal sac,** or **"tear-bag,"** lodged in a groove in the lacrimal bone on the side of the root of the nose. When distended this sac forms a protrusion at the inner angle of the lids and may be compressed by the finger, expelling its contents through the punctum into the tear-lake or into the nose. From the

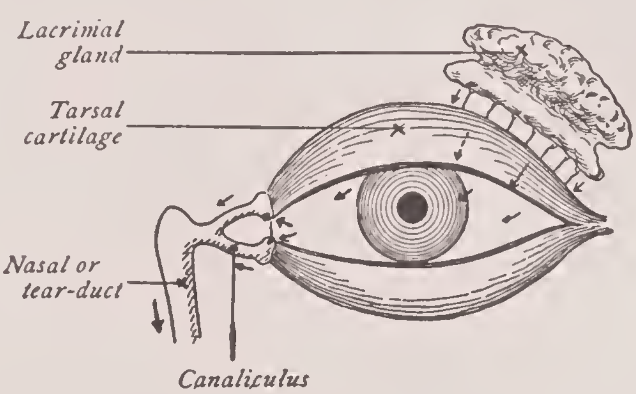


Fig. 111. Diagram of the origin and course of the tears, from the lacrimal gland over the front of the eye, then through the canaliculi and tear-duct into the nose.

lacrimal sac the tears are carried down through (5) a bony canal, ¾ inch long, called the **nasal** or **nasolacrimal duct,** into the nose.

The tears are secreted with some force by the tear-gland and so pass to the front of the eye, over which they are carried partly by gravity, partly by winking. This latter act also helps to force them into the canaliculi. If the eyes are full of tears and if the lids are forcibly closed a tear-drop is seen to be forced out at the inner angle of the eye on to the cheek. The nasal sac also acts like a pump drawing the tears out of the eye through the canaliculi. The oiliness of the edges of the lids, due to the Meibomian glands, is important in preventing the escape of the tears on to the cheek unless they are so abundant as to exceed the capacity of the regular route to the nose.

Ordinarily there is such a perfect balance between the secretion of tears into the eye and excretion of them into the nose that there is no accumulation of them in the eye and we are unconscious of the flow. As fast as they reach the nose they are removed by evaporation and carried away in the breath which derives part of its moisture from

the tears, part from the moist passages of the nose, and a small part from the lungs.

Whenever, from emotion or by irritation from the wind, dust, pungent vapors, or intense light there is an excessive secretion of the tears they may overflow the lids and roll down the face as well as be felt in the nose. In crying or on a windy day there is an accompanying "sniffling" or "watering of the nose," due to the increased flow of tears into the nasal chambers. Infants do not shed tears until after the third month.

Constant excessive tears with overflow on the cheek, or **epiphora,** commonly called "tearing" or "watering of the eyes," may be due to: 1. Vapors or dust or chemicals, irritating, as in case of millers, metal-grinders, excessive smokers, etc.; 2. inflammation of the lid-membrane (conjunctivitis); 3. eye-strain, either from excessive reading, or from working in bad light or from defective eyes. If careful inquiry into the patient's habits and an examination of the inner lid-surfaces discovers no cause for the watering of the eye, examination of the retina is advisable. When the tear-sac is distended and inflamed **(dacryocystitis)** very serious results may occur if the condition is not properly treated by a physician.

The Eyeball.

The conjunctiva is the thin, transparent mucous membrane that covers the front of the eyeball and passes from it to the inner surface of the eyelids, forming, when the lids are shut, a closed sac. Except over the cornea, the conjunctiva has many blood-vessels, and on account of its many small blood-vessels it easily becomes congested from irritation, injury, or disease, as in what is popularly known as **"pink eye"** or **"red eye."** As an example may be noted the quickness of the eye to become red in weeping or from the irritating vapor of tobacco-smoke, or lodgment of a small foreign body.

The conjunctiva is continuous, through the nasal duct, with the mucous lining of the nose and throat. Hence in inflammation of the nasal mucous membrane, as in an ordinary "cold in the head" or in influenza, the conjunctiva usually becomes much congested. In fact, in such cases some people speak of "catching cold in the eyes."

True inflammation of the conjunctiva is called **conjunctivitis.** Ordinary catarrhal conjunctivitis, or "red eyes," is most commonly due to eye-strain, and until excessive eye-work is given up and the proper correcting lenses are got to work, it will persist. Students who use their eyes too much and often by poor light, firemen, pud-

dlers, and others who are exposed to strong or dazzling lights, are subject to conjunctivitis. Other causes of conjunctivitis are chronic nasal catarrh, diseases of the tear-apparatus, working in irritating vapors, excessive smoking, particularly while sitting in-doors, with clouds of smoke constantly wreathed about the head and face. The roughened lid causes a continual feeling of foreign body in the eye which makes the patient rub and further irritate the eye more. The burning and smarting are sometimes unbearable. A pleasant eye-lotion for such cases is a 2 per cent solution of boric (or boracic) acid in water (which has been well boiled and strained), to be dropped into the eye frequently.

Purulent conjunctivitis (inflammation of the conjunctiva with pus-formation) is fortunately a rare disease, as it may be quickly fatal to the eye, causing the clear cornea to ulcerate, and destroying not only the sight, but even the whole eyeball. Purulent conjunctivitis of new-born infants is the most prolific cause of blindness. Immediately upon the appearance of red eyes within the first few days of life a physician should be called. **A few hours' delay with home treatment may result in blindness for the child.** Great care must be taken to prevent contagion in any household in which there is a case of purulent conjunctivitis. All towels, cloths, compresses, etc., used on the patient must be thoroughly disinfected, and the soap and basins used should be kept separate. If only one eye is infected every precaution must be taken to avoid infecting the other eye from the first one. One individual with purulent conjunctivitis has infected a whole family, several of the cases resulting in blindness.

"Granular lids" is the popular name of ordinary chronic conjunctivitis. True granular lids, or **trachoma,** is a much more serious thing and is very obstinate to cure or even improve much. The inner surface of the lids becomes roughened in this disease and by constantly irritating the cornea inflames it and damages its transparency. The inflammation also causes distressing distortion of the lid-borders, owing to the resulting scar-tissue which later contracts. This causes alteration of the direction of the eyelashes, so that they turn in against the globe, a condition known as **entropion.** This disease is commonest among the poorer people, and especially where many are huddled together in one dwelling and where dwellings are closely built together. It is often almost epidemic in soldiers' barracks and charitable institutions. When once an inmate of an almshouse, asylum, or school has been attacked by a severe conjunctivitis of any kind, he should be immediately reported to the physician and for-

bidden to use the public towels, soap, or wash-troughs, and should be isolated from his fellows until his disease is cured. Applicants for admission to large institutions or conscripts for military service should have their eyes scrupulously examined, with eversion of the upper lid, to make sure whether there is trachomatous disease present.

There is nearly always some conjunctivitis in measles, and the "measly eye" is familiar. Certain other infectious diseases, such as scarlet fever, small-pox, and diphtheria, may seriously affect the conjunctiva and cornea, even causing blindness. The nurse and medical attendant in their anxiety to attend to the chief disease should not neglect the necessary precautions to protect the eyes from serious injury.

Subconjunctival hemorrhages are usually due to a blow or other injury, but they sometimes occur spontaneously, often in the night while the person is asleep. It may be said that this is usually indicative of brittle or degenerated walls of the blood-vessels, and that unless proper precautions are taken a cerebral apoplexy may follow. Hemorrhages of the conjunctiva sometimes occur in the congestion of the blood in the head, violent coughing or in straining at stool.

Many persons suffering more or less continuously from inflamed eyes treat themselves and pay no regard to the **cause** of the disease. They resort to the quack "eye-waters" or "eye-drops," many of which contain powerful drugs, such as cocain and atropin, the constant use of which only further increases the trouble.

Is hot or cold water the better for the eyes? Many persons with healthy eyes continually bathe their eyes "to make them strong." Healthy eyes do not need the continued use of an eye-wash, nor to be opened under water. Much exposure of the conjunctiva to water will cause irritation. In **acute** inflammations the application of cold water is soothing and lessens the inflammation; but after the inflammation is well established, continued applications of very hot water may stimulate the blood-vessels to contract, thus reducing swelling, and relieving pain. However, in cases of **chronic** conjunctivitis the patient is usually suffering from some cause that acts more or less constantly, most likely eye-strain; and instead of attempting to treat the disease himself or carelessly allowing it to progress, he should consult an oculist as to the need of wearing glasses or of other treatment. If the habit of using an eye-wash is firmly established, a very pleasant and harmless lotion consists of 40 grains of boric acid dissolved in 4 ounces of distilled water, rose-water, or camphor-water; filter the solution.

To use an eye-lotion the patient throws the head far back or reclines in a chair or on a couch and looks upward. The lower lid is gently pulled downward by a finger-tip placed on the cheek, and with a clean glass pipette or eye-dropper several drops of the solution are placed in the outer corner of the eye. The eyes should not be tightly closed, as that squeezes all the lotion out on the cheek; but the eyeballs should be slowly rolled about, spreading the fluid over all parts. The lotion should be allowed to remain in the eye, and should not be wiped out with a handkerchief. The pipette should be kept in a clean container or cleansed before use again. The lotion may be kept in a bottle with a small neck to allow the glass pipette to act as a stopper in place of the ordinary cork. The use of **eye-cups** is not a good thing.

Growths in the Conjunctiva.—Fatty growths in the conjunctiva sometimes cause needless alarm. A **pinguecula** is a small, yellowish growth on the conjunctiva of the eyeball, which may continue to increase in size but never causes discomfort nor needs treatment. A **pterygium** is a somewhat triangular fleshy growth on the conjunctiva with its base toward one corner of the eye and its apex toward the pupil. This growth is common in old people, and especially in those exposed for years in outdoor occupations, for instance, in sailors. It is not dangerous, and if it is unsightly or enlarges so much as to interfere with the motion of the eyeball or to interfere with vision it can be easily removed.

The cornea is the window of the eye. It occupies the anterior fifth of the eyeball. It is transparent, very smooth and circular, and is fitted into the sclera (or outer coat of the eyeball) around its edge in the same way that a watch-crystal is inserted into the groove in its ring. It has no blood-vessels, but is supplied with lymphatic channels and an abundance of nerves, making it very sensitive. The cornea is very tough and resistant, but as it is the part of the eye most exposed it is frequently injured, affording a common location for lodgment of foreign bodies. It is washed with tear-secretion continually to clear it of small particles of dust and to keep it smooth and transparent. Diseases of the cornea are very painful on this account. Disease of the cornea impairs its transparency and is very disastrous to vision, especially when the central portion over the pupil is affected. The white scars which are apt to result greatly interfere with vision. Unless when formed in early childhood, these opacities are not likely to disappear.

Disease of the cornea occurs particularly in persons in poor

health, and in sickly children, who usually show signs of ill-health elsewhere, such as bad teeth, nasal catarrh, etc. For such cases a vigorous tonic and nourishing treatment is as necessary as local attention to the eye. In all diseases of the cornea there is steaminess or grayish spots on it, best seen in an oblique, concentrated light; the vision is indistinct; a doctor should be consulted at once, as blindness is very liable to result.

Persons who have not made a careful study of the eye often mistake white scars of the cornea, resulting from injury or disease, for cataract. Corneal opacity that has existed some time cannot be removed, and is a common cause of incurable blindness; in fact, in former years the greater number of inmates of blind asylums had opacity of the cornea following either "sore eyes of the new-born" (ophthalmia neonatorum) or small-pox.

Arcus senilis is an opaque condition of the periphery of the cornea, generally occurring in aged persons. By the uninformed it is sometimes mistaken for beginning cataract. It is due to a senile, degenerative process, is not dangerous to the eyeball, and never interferes with vision, as it leaves the center of the cornea clear.

The sclera forms the remaining four-fifths of the outer coat of the eyeball. It is continuous with the cornea in front. It is opaque, tough and fibrous, and forms the chief support of the eyeball. Owing to the whiteness of its anterior surface it is commonly called the "white of the eye."

The iris is a ring-shaped membrane consisting of elastic and muscular tissue, blood-vessels, and nerves. It is stretched across the front of the eye like a curtain a short distance behind the cornea. The iris is so-named from its color (**iris** is Latin for "rainbow"): when an eye is blue or brown this is the color of the iris. This color of the iris is due in part to a pigment, and in part to certain phenomena of reflection of light from the uneven surface.

The color of the iris at birth is blue, which, however, changes in the first few weeks to the permanent color. In **albinos** there is an absence of pigment in the iris as well as in the hair and skin, allowing the red color of the blood-vessels in the choroid to shine through and give the eyes a pinkish hue. One function of the pigment of the iris is to absorb light-rays and prevent their reaching the retina and causing dazzling, hence in albinos there is distress on exposure to strong light. There is a popular superstition that certain colored eyes are "stronger" than others. There is nothing in this other than that

a dark-colored iris perhaps better protects the retina from intense sun-glare, and hence is more common among the tropical nations, while light-colored eyes are more general among the northern races. This difference, however, may be due simply to the greater abundance of pigment in the skin and whole body in tropical races. In our climate bluish or grayish eyes are as serviceable as those of darker color.

The **pupil** is the opening in the center of the iris. It varies in size: by the radial contraction of the iris the pupil is enlarged; by the circular contraction of the inner edge of the iris (which bounds the pupil) it is made smaller. In this way the amount of light entering the eye is controlled: the pupil is small in bright light and large in dim light. Certain drugs, emotions and states of the body affect the size of the pupil. Thus, belladonna dilates the pupil—hence its name, which is Spanish for "fine lady," since it is supposed to enhance the beauty of a lady's eye by this property of enlarging the pupil.

Thus the chief function of the iris is to regulate the amount of light admitted to the interior of the eye, acting like the diaphragm in a photographic camera. This has a protective as well as an optical purpose. In a strong light the pupil quickly contracts, shutting out excessive light; while in subdued light or semi-darkness it dilates and allows more light to enter. When looking at a distance or when looking abstractedly into space the pupils dilate. Artists portray pensiveness or reverie by large pupils in the eyes. In using the eye at close range not only is the **accommodation** brought into play as described later, but the pupil is also contracted, allowing more distinct vision by giving a clearer, better defined image on the retina by shutting out the rays that would pass through the peripheral parts of the lens. This may be easily demonstrated by anyone with defective vision who will look through a pin-hole in a disk or card. They will see dimly but almost as distinctly as with their glasses. Or it can be shown in a normal eye by looking at a printed page held close to the face and interposing a card with a pinhole between the eye and the page.

Any disorder in the movements of the pupil indicates either inflammatory adhesions of the iris or serious brain- or nerve-disease. The pupil may also become dilated and inactive by the use of certain drugs called **mydriatics**. Among these are belladonna (and its extract, atropin), cocain, and homatropin. **Myotics** are drugs which contract the pupil. Among these are calabar bean (and its extract, eserin) pilocarpin, and opium. One of the prominent symptoms of profound

opium-poisoning is a pupil as small as a pin-head, which dilates just before death.

The Size of the Pupils.—In health the pupils are of equal size and react together to light, but the normal size differs in different persons. Late in life the pupil becomes gradually smaller, in a measure compensating for the ocular defects incident to age. Marked inequality in the size of the pupils is generally, though not always, due to serious injury or disease of the brain or nerves.

Large pupils are considered a sign of beauty, and sometimes actresses, singers, and other women who appear in public unwisely produce an artificial dilatation of the pupils by the use of a weak mydriatic solution. People with very active sympathetic nervous systems have large pupils, are more subject to asthenopia (or headache from eye-strain) from astigmatism or other defects of the eye. It is in such people that "weak" correcting lenses produce the most marked beneficial effects. Strong emotions and passions cause dilatation of the pupil. In the typical picture of fright the pupils are dilated and the eyelids are widely parted. In sleep the pupils are contracted. This probably helps one to see better at once on waking, especially in a strong light.

Ordinarily the pupil appears black. Rays of light entering the eye through the pupil are mostly absorbed by the dark pigment in the retina and choroid, but a few are reflected back always in the same direction in which they enter; and as an observer's eye is not the source of light nor usually in line with the source of light, so the pupil appears black. When, however, the observer's eye is situated in the source of light (or placed in the line of direction of the entering rays), the interior of the eye becomes visible. This is the fundamental principle of the **ophthalmoscope**, the simplest form of which is a mirror in the center of the silvered back which is scraped an opening, through which the observer looks at the eye under observation. By reflecting the light of a lamp flame into the observed eye and looking through the sight-hole in the mirror the interior of the eye is seen through the pupil. This appears red because of the blood-vessels. By coming closer to the pupil there may be seen the blood-vessels of the retina and the white spot of entrance of the optic nerve. By darkening the room and placing the source of light back of the subject's head, the pupil becomes dilated and the observer then gets a much better view.

In subdued light the pupils of certain animals, for instance the house-cat, seem to glow. This is due to reflection from a modified

choroid, called the **tapetum lucidum,** a bright greenish membrane between the retina and the sclera.

Inflammation of the iris, or **iritis,** is very painful and dangerous, sometimes causing blindness. At the onset it is like conjunctivitis, and is often attributed to "catching cold in the eye." To treat it by home remedies or common eye-lotions only allows the disease to progress so far as to bind the iris down to the lens-capsule, and the iris may become permanently adherent with resultant loss of the proper position and powers of the pupil. A few drops of atropin solution applied under the guidance of a skilled oculist would prevent this disaster.

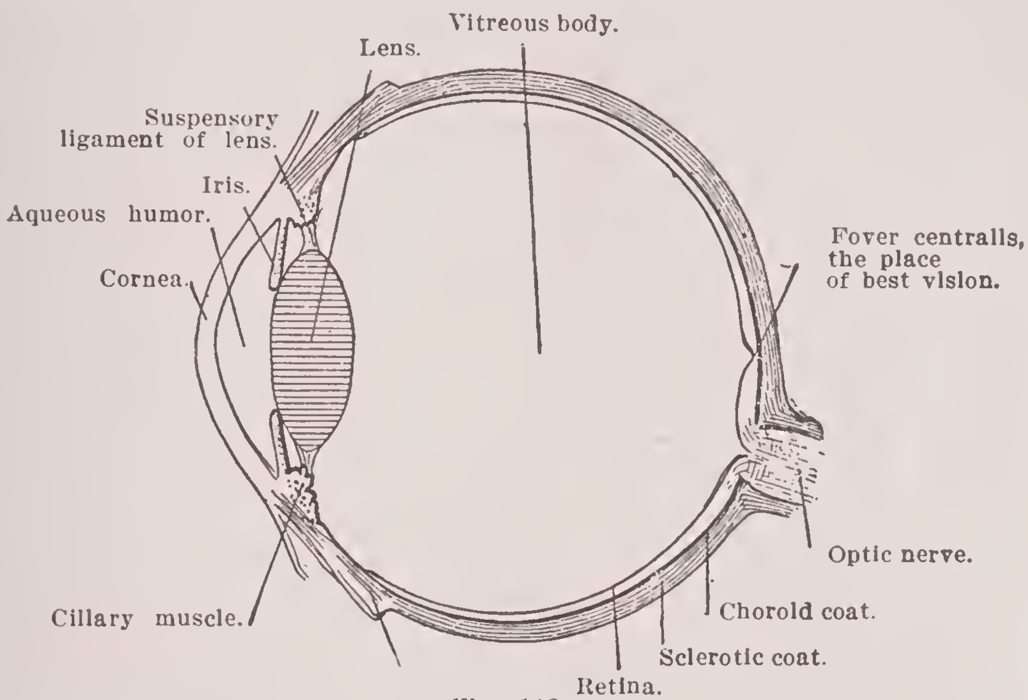


Fig. 112.

The ciliary body is a ring-shaped structure at the junction of the iris and choroid. It is composed of sixty or seventy folds or wrinkles of the anterior margin of the choroid, called the **ciliary processes,** together with a grayish band of muscular tissue about one-eighth inch broad, called the **ciliary muscle.** Some of the muscle fibers are radiating and the others are circular; the former arise from the junction of the cornea and sclera, and pass backward to the choroid opposite the ciliary processes; the circular fibers are internal, and lie near the peripheral part of the iris. This little muscle is very important in accommodation and is spoken of at length later under Eye-strain.

The choroid is the vascular and pigmented coat of the eyeball, covering the posterior five-sixths, extending as far forward as the cornea and forming the **ciliary processes** on its inner surface ante-

riorly. It lies between the sclera, which is external to it and the retina internal to it. It carries the blood-vessels for the retina and absorbs superfluous light, thus preventing its being reflected and so causing confusion. Inflammation of the choroid, or **choroiditis,** is generally a part of general disease of the blood-vessels. Other causes are injury, infection, marked near-sightedness, and retinitis. Disease of the choroid is very fatal to vision, because it involves the retina, the ciliary body, and the iris.

The retina is the innermost of the three coats of the eyeball, and is the most essential part of the peripheral portion of the visual apparatus. It is the receiving end-organ, and anything stimulating it or any part of the fibers from it to the brain, or the visual centers of the brain, causes the sensation of **light.** Thus, pressure or a blow on the eyeball stimulates the retina and causes us to see light or "see stars." It is composed of three main layers: 1. The inner, of nerve-fibers and nerve-cells; 2. the granular, middle layer; and 3. an internal layer, composed of the rods and cones and pigment. The rods and cones are the primary sight-elements or light-receivers, and it is within this layer that an image of an object is formed when the object is most distinctly seen. The light entering the eyeball traverses: a. the cornea, b. the aqueous humor, c. the lens, d. the vitreous humor or body, e. the inner layer of the retina, f. the middle layer of the retina, and finally reaches the rods and cones, from which it is transmitted back again through e and f to the optic nerve, and by it to the visual centers in the brain. The retina is well nourished, being freely supplied with blood-vessels.

The most sensitive part of the retina is the **macula lutea,** or yellow spot, an area about one-fiftieth of an inch in diameter, to the lateral or temporal side of the entrance of the optic nerve. In the very center of this part of the retina is the **fovea centralis,** or central hollow, in which all the layers are absent but the cones. So important is this minute portion of the eye that if it alone is destroyed by disease, useful vision is lost, although the rest of the retina may be intact. In such a case, if the patient looks directly at an object he can not see it, although he has an indistinct view of the objects about it. In reading or working at close range such a person is helpless. On the other hand, large areas of the surrounding retina may be destroyed and yet useful vision be retained if the macular region is intact, the side vision only being limited. However, defects in the retina may cause blind spots in the field of vision. These are called **scotomas.** There is a natural "blind spot" at the entrance of the optic nerve.

This may be demonstrated by experiments with the cross and circle described on a subsequent page.

The retina has been compared to the sensitive plate of a camera, and from this comparison have arisen absurd statements as the finding of a photograph of a murderer in his victim's eye. The retinal images are not permanent, nor even very persistent, although they do remain about one-eighth of a second. It is essential to good vision that the retina can receive a rapid succession or change of image. However, even this rapidity has a limit. If a firebrand be whirled around rapidly in a circle it is impossible for the eye to separate the images of the fire at every point of the revolution; and instead of several pictures of the burning brand a continuous circle of fire is seen. This is because the retinal images have a period of duration. By looking intently at a luminous object for some time and then turning the gaze on a black or gray wall or ceiling for a moment, there will be still seen the image of the object before the eyes against the new surface. This is known as the **after-image.** At first it is of the same color as the object—**positive** after image, which is very quickly replaced by an image in colors complementary[1] to the original ones—**negative** after-image. To see a retinal image in the eye of a human being as described in sensational newspaper reports the observer would have to use an ophthalmoscope.

The optic nerve connects the retina with the brain. It carries only sensations of light but not the sensation of pain. Disease or injury to the retina and optic nerve may be so severe as to cause blindness without the victim ever suffering the slightest pain. When suddenly shocked, the optic nerve, instead of giving pain, gives rise to indefinite sensations of light, commonly known as "seeing flashes" or "stars." Unlike the retina, the optic nerve cannot receive impressions of light. It can only **conduct,** much like a telegraph wire. At the point of the retina where the optic nerve enters there is a normal blind spot which is projected into the field of vision and is known as **"Mariotte's blind spot."** This may be readily demonstrated by fixing the right eye on the cross in the figure below. Closing the left eye and moving the page to about ten inches from the eye the circle will entirely disappear; at this distance the image of the circle falls directly on the nerve-fibers where they enter the retina to spread out (or, more correctly, collect to leave the retina). Here there are no rods and cones.

[1] When one color combined with another makes white light each of these colors is complementary to the other. Thus *red* and *bluish green* are complementary to each other because when combined they make *white*.

Serious disease of the optic nerve produces blindness by interrupting conduction between the retina and the brain. It is generally the result of systemic disease, but may be due to excessive use of alcohol, tobacco, or to other poisonous substance. Complete atrophy of the optic nerve is an incurable disease. There is not even perception of light left, and contrast between bright light and darkness is lost.

Fig. 113. To test for the "blind spot" of the eye. Close or cover the left eye. Look at the cross with the right eye, and move the book nearer or farther away. At about 10 or 11 inches away the white spot cannot be seen, because then it is just opposite the optic disc or entrance of the optic nerve to the retina, but farther off and closer than this it can be seen.

The **aqueous humor** is a water-like liquid which fills the space between the lens and the cornea and bathes both surfaces of the iris. It is highly alkaline and is perfectly colorless and transparent. The **vitreous humor**, or **vitreous body**, is a clear, transparent, colorless, jelly-like substance which occupies the large part of the eyeball lying behind the crystalline lens. The transparency of the humors may be impaired by disease of the coats of the eyeball, causing either diffuse clouding and blindness, or only separate opaque bodies showing as **dark spots before the eyes.** These are, however, quite visible to the physician by means of the ophthalmoscope, and must not be confounded with the minute bodies known as **muscæ volitantes** ("flying flies") that are usually present in healthy eyes. These smaller opacities are not visible by the ophthalmoscope, but are readily seen by the patient, particularly if he is myopic or short-sighted. They are seen much plainer in looking at a uniform white surface, such as a light wall or the sky on a clear day. In certain cases of eye-strain they become very annoying, assuming different shapes, such as strings of beads, rings, flakes, etc., floating down before the eye and provoking the sufferer to try to look directly at them, when they fleet away. In some patients they are worse during attacks of "biliousness." These dark spots before the eyes are due to shreds of tissue in the vitreous body. Although they become very disturbing to the patient at times, as a rule they speedily diminish or are ignored when the defective eyesight is corrected by the proper glasses and there is rest from excessive use of the eyes.

The crystalline lens is a biconvex transparent circular body about

one-third of an inch wide and less than one-sixth of an inch thick. It is enclosed in a transparent, homogeneous capsule. It rests against the vitreous body behind and is partially covered in front by the iris, of which the inner edge (bounding the pupil) rests on the lens. The lens is bathed in front by the aqueous humor, and is held in place by the suspensory ligament which stretches from the edge of the capsule of the lens to the ciliary body. The substance of the lens is arranged in concentric layers composed of minute fibrils which are so dovetailed together as to give any slice through the lens somewhat the character of a coiled watch-spring, so that when the ciliary muscle contracts and loosens the suspensory ligament the lens becomes more convex anteriorly. This is spoken of later in describing accommodation.

Cataract is opacity of the crystalline lens or of its capsule. It may be partial or complete. It is not incurable, and does not always cause blindness. It is not a "growth on the eye," and must be distinguished from corneal opacities. In cataract the cornea is transparent, and the iris and pupil are readily seen; but the pupil, instead of being black, is grayish-white or creamy-white, and vision may be reduced to the mere recognition of light and darkness. Many people having unripe cataract are never aware of the fact, because that part of the crystalline lens behind the pupil does not become opaque in some cases. Perhaps only a few opaque radial streaks may be seen when the pupil is dilated by a mydriatic. This fact of the frequent harmless and trifling character of some cataracts is important, as often the oculist, after failing to improve the vision with glasses, has to explain to the patient the reason of his failure, and if the patient is nervous he imagines he has a horrible growth much like cancer elsewhere, and that he will become permanently blind. Proper measures—good hygiene, careful systemic treatment, and the use of the right glasses—incipient cataract will not only be arrested but may actually clear up to a slight degree. Again, so long as vision remains good in one eye there is no necessity of operating on a single cataract (i. e., cataract of one eye only).

The causes of simple senile cataract (or cataract coming on with advancing years) are not exactly known. Old age predisposes to it, but whether by lowered nutrition, general sclerosis or hardening of the arteries, or undue strain to accommodate in presbyopia, is not known definitely; cataract is certainly seen less frequently where proper care of the eyes is taken. It is rare among persons of the better classes who have been careful of their eyes and who have used

lenses ordered by competent oculists and changed at frequent intervals, instead of neglecting their eyes or using lenses selected by guess in an optician's or jeweler's store.

The use of proper glasses, the treatment of associated local or general disease, and the observance of proper care of the eyes may retard or prevent the ripening of incipient cataract; but the **treatment of mature cataract by drugs or apparatus is useless.** When once it is complete **there is no cure but a surgical operation.** Numerous remedies and treatments "without the knife" are often advertised. These are mostly solutions of some mydriatic, which dilate the pupils and allow the entrance of more light and hence improve vision **temporarily.** These are all meant to impose on the credulity of the victims of cataract, who are foolishly ready to try any treatment that may be substituted for the "dreaded operation," which is really safe and simple, and, fortunately, in the hands of a skillful surgeon, is almost always successful. The operation consists in cutting a slit in the rim of the cornea, opening the capsule of the lens, and removing the opaque lens. Of course, after the lens is removed, an artificial lens (in spectacles) must be worn in front of the eye. As the power of accommodation is lost with the natural lens, a second pair of glasses, or bifocal lenses, must be worn for near work.

Sometimes in the beginning of cataract the crystalline lens swells before it begins to become opaque, and owing to this change in the form and refractive power of the lens the aged person is enabled to read without glasses for the first time in many years. This is the so-called **"second sight."** However, if the vision for distance is examined it will very likely be found quite defective, and generally the typical opacity of cataract can be seen, and if the patient lives long enough vision is almost totally lost, and operation becomes necessary.

Injuries to the Eyes.—The numerous ways in which this delicate and important organ is protected by Nature have already been described. The bony orbit and the cushion of fat enclose the eye behind; the orbital margin, eyebrows, eyelids, eyelashes, and nose protect it anteriorly; while the tough sclera and cornea are not easily penetrated. When a blow or a foreign body quickly approaches the eye, the lids close and the eyeballs roll up automatically by reflex action, presenting the tough and opaque sclera instead of the important transparent cornea to meet the force of violence. In fact, in penetrating wounds of the eye from in front through the lids the injury is generally on the sclera below, the cornea having been too quickly rotated upward to be injured.

Foreign Bodies.—The most common injury is due to the entrance of small particles of dust, cinder, steel-filings, etc., into the conjunctival sac under the lids, i. e., between the lids and the eyeball, or into the substance of the cornea. The tears will often wash such particles (as are not embedded) to the inner canthus, where they cause no distress and can be seen by the patient and wiped out. However, the foreign body may lodge and be hidden from view behind the upper or lower lid or be embedded in the cornea, where it can be seen only with difficulty by the unaided eye. It will quickly cause painful rubbing, scratching and grating, which are often almost unbearable and necessitate complete closure of the lid before there is comfort. The eye soon becomes congested and the conjunctiva inflamed. In such cases the surface of the conjunctiva on the eyeball and the cornea should first be inspected in a good light or by oblique illumination with a magnifying glass. The lower lid is then drawn forward by firm pressure with a finger-tip below it and downward traction. If the offending particle is not seen behind the lower lid, the upper lid should be everted. This may easily be done without the aid of a probe or other instrument, and everyone should learn how to do it, as there is often occasion in traveling to relieve some unfortunate sufferer when traveling on a railway. The patient is told to look down, the edge of the lid and the lashes are seized with the thumb and forefinger of the right hand (while the whole hand is steadied by the other fingers rested against the forehead or cheek), and the lid is drawn at first forward and then downward away from the globe; then upward over the point of the thumb or forefinger of the left hand, which is placed on the lid and acts as a fulcrum. Instead of the thumb or forefinger a lead pencil or other slim object may be used over which to turn the lid. The foreign body should be removed with the corner of a clean handkerchief or with a wisp of cotton; but if it is embedded it may be necessary for a competent physician to release it with a fine forceps, or with the point of a sterilized needle, or spud, or a magnet under cocain-anesthesia. Embedded particles are most common in marble-cutters, grinders, engineers, firemen, and the like. In every shop there is some workman who is skilled in removing foreign bodies from the eye, and who may, in his ignorance of the serious consequences, pick at the embedded particle with a dirty knife-blade or needle, and without previously washing his soiled hands. Destructive corneal ulcers following such manipulations are seen too often in large eye-hospitals.

Wounds.—A foreign body often completely enters or even pene-

trates the eyeball, destroying vision not only of the injured eye, but sometimes that of its fellow by sympathetic inflammation on account of delayed or improper treatment. There is no more serious injury to the eyeball than penetration by a foreign body, and often vision not only is lost, but also the eyeball must be taken out to avoid sympathetic inflammation. An eye with a foreign body in it is always dangerous, as it is liable to break out at any time into active inflammation. In spite of these very real and great dangers the employees in such hazardous occupations generally refuse to wear protective glasses. There should be a rule in every establishment where the nature of the work causes many eye-injuries that no employee be allowed to work without protective glasses, and casualty companies should refuse to take risks on such employees unless this rule is enforced. The companies would thus do their patrons a great service, for not only is prevention better than cure—it is very much better than compensation.

Penetrating wounds of the eyeball are very serious, especially when in the ciliary region, and often necessitate removal of the eyeball. If, however, the lens alone is the seat of injury, a traumatic cataract may be the only result, and this may be absorbed under appropriate treatment, without more serious result than follows an ordinary cataract-operation.

Burns of the eye are not uncommon. Usually the conjunctiva and cornea are involved, and loss of movement of the globe or blindness may follow on account of contraction of the scar and adhesion of the raw surface of the lid to the ball, with perhaps opacity of the cornea. Quicklime is particularly dangerous to the eye and is a common cause of injury. An explanation of how it acts may help readers to avoid accidents with it. When water is put on quicklime (or calcium oxide, CaO) chemical union occurs, forming the hydroxide of lime (or calcium hydroxide, $Ca(OH)_2$). Much heat is generated in this chemical reaction and some of the water may be suddenly converted into steam with explosive force, throwing the quicklime about and possibly into one's face and eyes. The moisture in the eyes causes the quicklime to adhere and the above-described chemical change occurs in the eyes. Also, quicklime is strongly alkaline and caustic and destroys tissue on account of this property. The most important treatment in such cases is to remove quickly and thoroughly all the irritating substance. This should be followed by a drop of concentrated sugar solution put in the eye. Afterward the eye may be irrigated (or washed out) with a teaspoonful of sweet oil, which is very soothing.

In cases of acid-burns, bathing the eye with milk is helpful. As quickly as possible after the emergency treatment the case should be placed in the hands of a physician.

Eye-Strain.

The eyeball is a camera. Rays of light from an object enter the eye and are brought to form an image of the object, on the retina. The mobile iris acts like the diaphragm of a camera, shutting off rays which are too divergent to be properly focussed, while the remaining rays are focussed accurately on the sensitive surface of the retina by the cornea, the crystalline lens and the other refractive media of the eye (Fig. 109). The pigment in the retina and choroid has the same effect as the black interior coating in a camera, absorbing all light that is not useful or that has served its purpose. Instead of the retina retaining a permanent impression, however, like the sensitive plate of the camera, it is simply stimulated by the light-rays, and the resulting impressions are transmitted to the centers of sight in the brain by means of the optic nerve, optic tracts, etc., in a way somewhat analogous to telegraphy.

The eyeball does not see. It is only a sensitive end organ which **receives and transmits impressions** to the brain centers where the impressions become conscious sensations.

For perfect vision the following conditions are necessary: (1) The media of the eye must be quite transparent; (2) rays of light entering the eyeball must pass through the pupil and be focussed exactly on the retina; (3) the retina, optic nerve, and its continuations must be perfect; (4) the visual centers in the brain must be intact. In other words, the receiving, transmitting, and interpreting apparatus, which together make up the visual mechanism, must all be perfect. A disturbance of any part of the visual system will cause defective vision, and even blindness. In cases of cataract, the retina, optic nerve, and brain may be healthy, but the opaque lens prevents light from reaching the retina. In atrophy of the optic nerve or disease of the retina, the media of the eyeball may be perfectly transparent and may form perfect images on the retina, and the brain may be healthy, but blindness exists because the impressions are either not received or not transmitted. In disease of the visual centers of the brain the whole eyeball may be normal and the optic nerve perfect, but blindness results because the brain can not interpret the impressions transmitted to it.

The changing of the direction of rays of light is termed **refraction.**

By this property of refraction the transparent substances of the eye are able to form images on the retina. This is done by bringing to a point rays of light which come from each point of an object. This is termed **focussing.** For perfect vision the image of what is looked at must be focussed on the retina.

In the following pages are considered the defects of the eye in regard to focussing and how they may be remedied.

Emmetropia is the refractive condition in which rays of light entering the eyeball from a distance are focussed exactly on the retina when the eye is passive, no muscular action being present. The emmetropic is the normal eye.

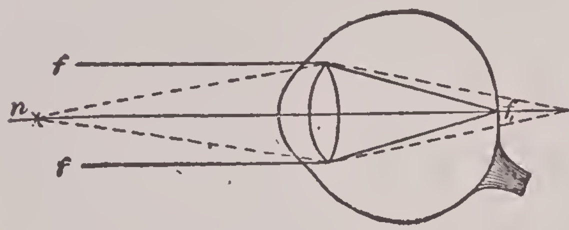


Fig. 114. The normal eye at rest (or passive). Parallel rays, *f, f,* (or rays from distant point) focus on the retina (and thus give distinct vision of a distant object). Divergent rays, as from *n,* strike the retina before they would meet at *n.*

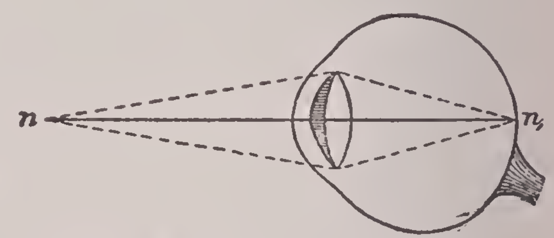


Fig. 115. The normal eye *accommodated* to see a near object. The shaded part of the lens represents the increased curvature of the lens, by which rays from *n* are focussed at *n.* Compare with the preceding figure.

Ametropia is the refractive condition in which rays of light coming from a distance (and hence nearly parallel) and entering the eyeball are not accurately focussed on the retina. There are three varieties of ametropia: **hypermetropia,** or more usually shortened to **hyperopia** (far-sightedness), **myopia** (near-sightedness), and **astigmatism.**

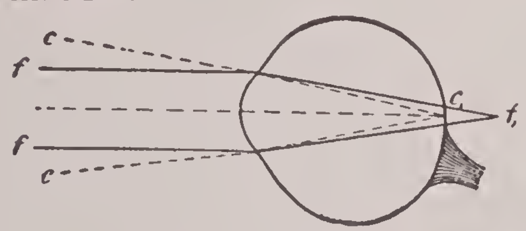


Fig. 116. The far-sighted eye. Parallel rays, *f, f,* are brought to a focus *behind* the retina (or strike the retina before coming to a focus). Only *convergent* rays, like *c, c,* can be focussed *on* the retina—hence such an eye requires aid of a convex lens (which *converges* rays).

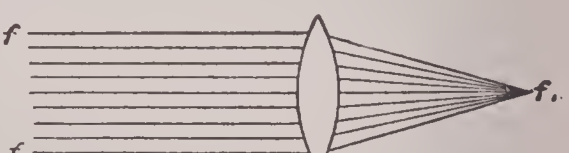


Fig. 117. The effect of a convex lens. Parallel rays *f, f,* are brought to a focus, *f.* This is known as the *principal focus,* and its distance from the lens is the *focal distance* of the latter.

Hyperopia (far-sightedness).—In this condition the eyeball is too short, and rays of light from a distance reach the retina too soon, before they are focussed, or it might be said that they are **focussed behind the retina.** Instead of being distinct as in the normal eye, the

image is blurred. By using the accommodation (see later) the lens can be made to focus the distant rays on the retina of a hyperopic eye. But near objects can not be focussed on the retina. Hence, a person with hyperopic eyes is said to be "far-sighted," because he can not see objects that are close but must hold them off a bit. Hyperopia is corrected by a convex lens which aids the eye to converge the rays of light and bring them to a focus in the retina.

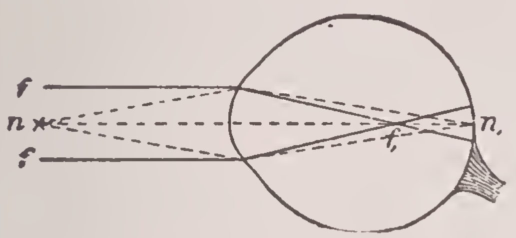


Fig. 118. The myopic or short-sighted eye. It is too long from front to back, hence parallel rays (or rays from a distant point) meet and cross before reaching the retina, causing blurred vision. For distant vision this eye requires a concave lens like the one in the next figure, which makes rays diverge. The dotted lines, *n*, *n*, show that the near object can be focussed on the retina and hence clearly seen.

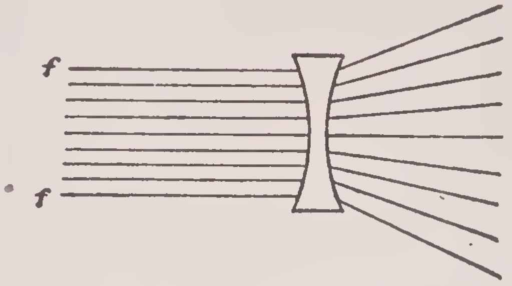


Fig. 119. A concave lens causes parallel rays, *f*, *f*, to become *divergent.*

Myopia (near-sightedness).—In this condition, owing to too great length of the eyeball or to excessive refractive powers in the media, rays of light from a distance are focussed in front of the retina, and have crossed and spread a little before reaching the retina, producing an indistinct image. The myopic eye is adjusted for close range when passive, rather than for distance. Myopia is corrected by a concave lens, which diverges rays of light, thus prolonging the focal distance and shifting the image back to the retina.

The point for which the eye is focussed when passive is termed the **punctum remotum,** remote or distant point. It may be only a few inches from the eye in myopia, is over 200 feet away in emmetropia, and is "beyond infinity" for hyperopia. In other words, the passive eye will form divergent rays on the retina if myopic; it will focus parallel rays if normal or emmetropic; and it will focus only convergent rays on the retina if hyperopic. Thus the meeting point of the rays which the various kinds of eye will focus, when passive, is a short distance in front of the near-sighted eye, at infinity for the normal eye, and **behind** the eye for the far-sighted.

Astigmatism is a condition in which the focus is not the same in all meridians of the eye. Thus the focus of light-rays in the horizontal meridian may be different from the focus in the vertical meridian. In simple hyperopia or myopia **all the meridians** of the

eye are equally defective. In **simple astigmatism** one principal meridian is normal while the other, at right angles to the preceding is faulty. In **compound astigmatism** both meridians are hyperopic or myopic, but unequal in degree. In mixed astigmatism one meridian is hyperopic while the other is myopic Astigmatism does not depend on the length of the eyeball, but upon the irregular or distorted curvature of the cornea, and rarely that of the lens. In this condition a point of light focusses as a blurred line on the retina. Astigmatism is corrected by a cylindric lens, which has a plane surface in one axis and a curved surface in the axis at right angles to it. This form of lens is really a slice cut from the side of a cylinder of solid glass. The axis of the cylinder is placed at right angles to the faulty meridian to correct the astigmatism.

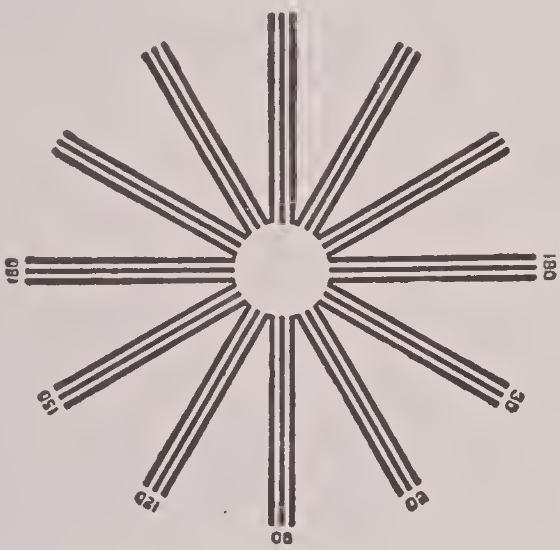


Fig. 120 To test *astigmatism* or irregular curvature of the eye. An astigmatic eye sees one set of lines sharp and black, while the others are blurred.

A person with simple astigmatism, on looking at an astigmatic chart with each eye separately, sees certain of the lines in the defective meridian very much blurred, while those at exact right angles appear clear and black. This furnishes a test for astigmatism, because to a normal eye all the lines appear of equal distinctness and blackness. Astigmatism is very common, and although hyperopic and myopic eyes are spoken of as if they occurred alone, yet **nearly all** eyes in highly civilized communities are in some degree astigmatic.

Accommodation.—In the preceding description of eye-defects the eye has been regarded as at rest, focussed for nearly parallel rays from a distance, or, in other words, in a state that should enable it to see objects at a distance when an object is close to the eye and the light-rays from each point on the object entering the eye have an appreciable divergence; yet it is quite possible up to middle age to

form distinct retinal images of objects within a few inches of the eye. This change of focus is effected by an act called **accommodation,**

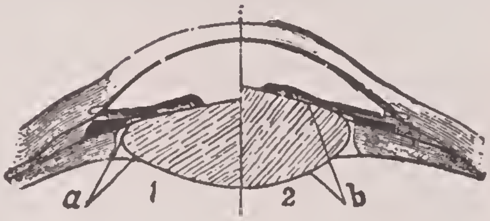


Fig. 121. Section or cut through the front part of the eye. 1 shows one-half of the lens when it is "unaccommodated" for distant vision; 2 shows it accommodated for seeing a near object; *a*, suspensory ligament, and *b*, capsule of the lens. Note the iris lying on the front of the lens, covering all but the central part or "pupil," which (as is shown here) is smaller for near vision.

which is accomplished by an increase in the convexity of the crystalline lens. This lens is held in place by its suspensory ligament, the tension of which is controlled by the **ciliary muscle** (see under "Ciliary Body"). When the eye is at rest the suspensory ligament is tense and pulls on the edge of the capsule of the lens all around so that the lens is flattened somewhat. During accommodation the ciliary muscle contracts, draws in the attachment of the suspensory ligament and thus relaxes the latter, and the lens bulges forward by its own elasticity and the refractive power is increased. The more the surface of a lens curves the more it refracts and the quicker it brings rays to a focus. By means of accommodation all reading, writing, sewing, and other near work is made possible. The power of accommodation is greatest in early life, and gradually diminishes until about the age of forty, when reading at the ordinary distance becomes uncomfortable, because the lens has gradually lost its elasticity and no longer bulges forward as much as it should when the ciliary muscle is contracted. At about seventy-five years the accommodation is practically lost, as the lens is then rigid.

The nearest point at which an object or printing can be distinctly seen is termed the **punctum proximum,** or near point. It is about seven or eight inches away for the normal eye, closer for the near-sighted eye and further off for the far-sighted, or it may be impossible for a very far-sighted eye to see distinctly at any distance, even by using all the power of accommodation. The distance between the far point and the near point is the **range of accommodation.** It is gradually reduced with age, as the near point recedes until in the aged the near and the far points coincide.

This natural **failure of accommodation** beyond the point of comfortable reading is called **presbyopia, or old-age sight,** and every person over forty-five years who has had either normal or far-sighted eyes should wear glasses to read and perform other close work. Presbyopia is corrected by convex glasses, which must be increased in convexity or "strengthened" every few years. The presbyopic

correction must be added to any distance-correction that was needed before. Old persons cannot wear the same glasses for distance and for near, because of their loss of the power of accommodation. They must have strong glasses for near work and weaker ones if necessary for distance.

Near-sighted persons, although unable to see distinctly at a distance, are enabled by their greater refractive power to read without glasses even in old age. Sometimes the distant point of a near-sighted eye is as close to the eye as the ordinary reading-distance (twelve to fourteen inches), and in such cases the person can read without accommodation when the page is at the "far point" of the eye. Whenever a person is heard boasting of the ability of himself or some relative to read in old age without glasses, it is only because instead of the vision being extraordinarily preserved, the eyes are really near-sighted, and perhaps all through life distance-vision without glasses has been imperfect, although reading and near work were possible.

Marked difference in the refraction of the two eyes in the same person, is not unusual; in fact, one eye may be far-sighted and the other near-sighted, and yet the patient, being able to read at a distance with the far-sighted eye and at close range with the near-sighted one, may go through life without knowing that his eyes are different or defective. Strange to say, persons are sometimes seen who have been almost blind in one eye from childhood, and who have become aware and conscious of it only when told by an oculist. As a rule, however, inequality of the refractive power of the two eyes is very likely to cause severe eye-strain with all its symptoms, and to necessitate a visit to the oculist.

Eye-strain.—Very few eyes are perfect. Most persons are slightly far-sighted or astigmatic, yet many such persons have apparently perfect vision. Near-sighted persons, however, always show defective vision, although near vision may be perfect and close work may be done well and comfortably.

How can far-sighted or astigmatic eyes give perfect vision? The answer is, Simply by the use of accommodation. By constant strain of the ciliary muscle the crystalline lens is so increased in curvature as to counterbalance exactly the optical defects of these eyes, and so long as the accommodation holds (i. e., well into middle life) distance vision is possible. If a person with such eyes follows an outdoor occupation, and uses his eyes little at near work, and his health keeps good, there is no consciousness of eye-strain. But if the employment

is indoors and needs vision at close range as in reading and in studying, or if the general health fails, there may develop, from the incessant expenditure of nervous and muscular energy in keeping the eyes accommodated, a chain of symptoms collectively known as **asthenopia** (from Greek words meaning "lack of strength owing to the eyes").

The multiformity of the effects of eye-strain can be properly realized only when it is understood in our lives how necessary vision is to every act. The visual centers are in very close connection with the other brain-centers, and the slightest disturbance of the visual mechanism, particularly if the eyes are used excessively at close range, produces sympathetic disturbance not only in the eyes, but **in the entire motor, sensory, and psychic systems**; in other words, the whole brain is affected and from it all parts of the body. Fortunately the manifold effects of eye-strain, so long ignored or unknown, are being better appreciated every day, and cases of chronic inflammation of the eyes and persistent headaches are now sent for examination of the eyes instead of being regarded as due to "biliousness," "sick headache," or some unknown cause.

Local Symptoms of Eye-strain.—There may be a continual feeling of discomfort in the eyes, which may even become very painful if used long for near work. After a few moments of reading the type blurs and the letters run together, and there may be a difficulty in following the lines. There may be twitching of the eyelids, and in extreme cases it may be very difficult to keep the eyes open in continued reading on account of drowsiness. The eyes may smart, itch, or burn, and continually "water;" or they may be red and congested both on the edges, on inner surface of the lids and over the eyeball. There may be great sensitiveness to light (so-called **photophobia**), causing the misguided patient to wear colored glasses instead of the proper colorless lenses.

General Systemic or "Reflex" Symptoms of Eye-strain.—One of the commonest reflex symptoms is headache, particularly that accompanied by nausea ("sick-headache") and made worse by reading, sewing, riding in the cars, riding backward, shopping, attending the theater, etc., although often there is no very apparent connection with excess in the use of the eyes. The headache is usually temporal or frontal, but it may be on the top of the head (vertical, i. e., pertaining to the vertex or top of the head) or at the base of the skull (occipital). The headache may be neuralgic, and may be limited to one side, and then not always on the side of the more defective eye.

In some cases the reflex disturbances are quite remote from the

eyes, and are not recognized as due to eye trouble. Obstinate constipation and indigestion are occasional results of eye-strain. Vertigo, general nervousness, nervous prostration, insomnia, and even chorea, or St. Vitus' dance, and epilepsy are some of the effects on the nervous system. In fact, the general health may be so lowered by the continual nervous drain of eye-strain that the most serious debility may result. Unless the patient comes under the care of a skillful physician, who knows the influence of eye-strain, he may be medicated, massaged, dieted, and given many other forms of treatment before the services of an oculist are sought and the true cause of the condition learned and removed.

Eye-strain as a reflex cause of systemic troubles is often overlooked because of the fact that sometimes when the reflexes are most prominent there is little or no local disturbance in the eye. And on the other hand, eye-trouble that is due to some condition outside the eye is often located locally without its being recognized that the origin of the trouble is not in the eye. Often patients with marked eye-symptoms may persistently seek relief by local treatment when the cause is not ocular. For instance, people are sometimes given expensive glasses by unscrupulous opticians for conjunctivitis which may be due entirely to some nose trouble. Again, pain deep in the orbit, with a dull headache, particularly bad on rising in the morning, occurs in some kinds of uterine disease. The pain in the eye and brow-ache of malarial fever are sometimes mistaken for asthenopia. The history of chills and fever will enable the physician to make the right diagnosis. In the early stages of locomotor ataxia the case may be carelessly dismissed as simply ocular, with a prescription for glasses, and the real disease progresses unrecognized. Such cases are clearly and undeniably arguments for the necessity of medical supervision in the diagnosis and treatment of eye-strain; but, unfortunately, many opticians, who usually "give free examinations" and charge well for the glasses they prescribe and supply, and who know nothing of medicine, are the ones who alone are consulted.

The Eye-strain of Near-sight.—Asthenopia due to hyperopia and astigmatism which may be unrecognized on account of the ability to see quite well, has been referred to. In myopia near vision may be good although the distant vision is faulty. No amount of effort will improve the distance vision, because it is by relaxation of the ciliary muscle and tension of the suspensory ligament that the eye adapts itself to distance. It would seem natural for such a person to consult an oculist on account of poor distant vision. On the

contrary, many near-sighted persons, never having known any better distant vision, and being able to perform the finest work without effort, are likely to boast of their strong eyes. As a matter of fact, a near-sighted person can bring fine work much nearer to the eye than can one with normal eyes, and can see by so much the better in the case of such work. When given correcting-glasses they may even discard them, saying, perhaps, that distant objects look unusually bright or clear and small, but that they prefer the old familiar haziness and the easier near vision. Near vision is really easier for the myopic, because their myopia takes the place of accommodation.

The myope needs glasses just as much as the hyperope or the person with simple astigmatism. On account of the stretching of the ocular coats the nutrition of the structures of the eye is disturbed and often the membranes are vitiated almost to a point of true disease. In reading, the myope usually holds his book close, and strains his muscles of convergence, and pulls over-much on the globes to turn them in producing vascular congestion and compression of the eyeball, and in bending over he causes distension of the ocular veins. The uncorrected myopic eye is a "sick eye," and unless the amount of near work performed is limited or the proper glasses are obtained, with which to read at a distance from the eye, serious progress of the myopia and other disease of the eye may occur. The strictest attention to school hygiene, repeatedly correcting the constantly changing refraction of the eyes of school children is necessary to prevent the serious higher grades of myopia. Moderate myopia, when properly cared for may never cause the patient any discomfort other than that of wearing glasses constantly. Even if neglected myopia did not tend to increase or to cause intra-ocular disease, the slight inconvenience of wearing glasses is many times offset by the improvement in distant vision, allowing participation in outdoor sports and enjoyment of all the beauties of Nature. Proper glasses very literally greatly enlarge the world of a near-sighted person.

The Ocular Muscles.—The eyeball is moved by six muscles, namely, the superior, inferior, internal or lateral, and external or medial straight muscles, and the superior and inferior obliques. The muscles of the eyeball are sometimes affected by ametropic eyes (eyes with faulty vision). Squint, muscular imbalance or unequal action of the muscles, and muscular insufficiency are mostly caused by faulty vision and may be **prevented** by the early use of glasses, and often mitigated or entirely **cured** by the same treatment. Paralysis

of the ocular muscles usually results only from serious systemic disease.

The line passing through the center of the crystalline lens and the center of the fonea centralis (or the center of the area of the retina with the best vision) is the **visual axis.** It may also be defined as the line passing through the center of the pupil to the point looked at. When the visual axes of the two eyes meet exactly at the point

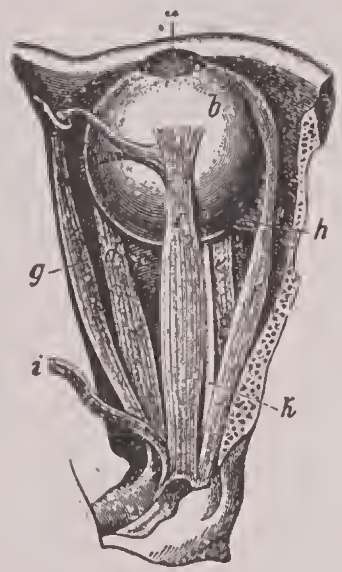


Fig. 122.
The right orbit (or eye-socket) opened from above. *a*, Cornea. *b*, Sclerotic coat of the eyeball. *c*, Superior, *d*, internal, *e*, inferior, and *f*, external rectus (straight) muscle. *g*, Superior, and *h*, inferior oblique muscle. *h*, Optic nerve. *i*, Muscle that raises the upper lid (cut across and turned aside).

one "looks at" or wishes to see best, the ocular muscles are said to be **balanced.** This muscular balance depends on equality or proportion in the size and nerve-supply of the various muscles that turn the eyeball. Any disturbance of any of the size, length, strength, nerve-sup-

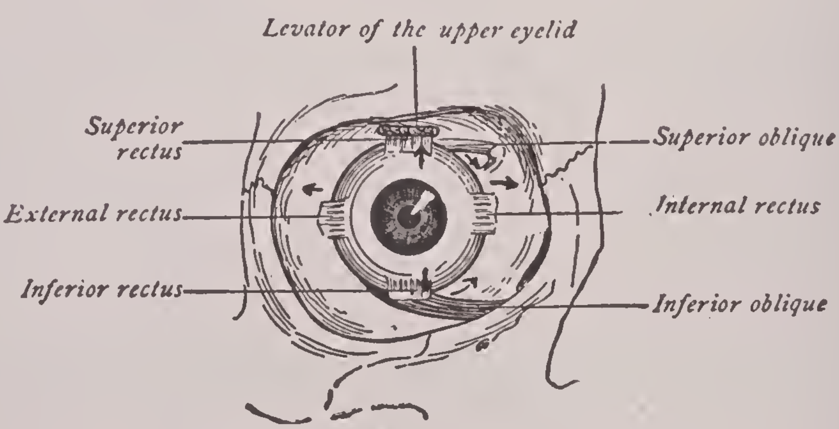


Fig. 123. Diagram of the muscles that move the eyeball. The arrows indicate the directions in which the eye is turned by each muscle.

ply, etc., upsets the muscular equilibrium. If a muscle is faulty in regard to its insertion or attachment, or in its structure, or if the nerve-supply is anomalous, **muscular imbalance,** or **heterophoria,** occurs. This, however, does not make binocular fixation (or "fixing"

a point with both eyes, i. e., looking at it with both eyes properly directed) impossible. The visual axes may be rightly directed by increased innervation to one or more of the muscles, and single vision maintained in ordinary work. In true **strabismus or squint,** or permanent deviation, however, this is not possible, and **diplopia (double-vision)** is avoided only by the use of correcting **prisms** or by excluding one eye from participation in the visual act. In other words, in true strabismus, perfect binocular vision is impossible without glasses, while in ordinary muscular imbalance, or heterophoria, binocular vision is maintained by increased innervation of part of the muscular apparatus. In the first, the anomaly is in some part organic, **i. e.,** affecting the structure; in the last, it is exclusively functional, **i. e.,** due to function or action, but not to structure. The study of the functional anomalies of the ocular muscles is very important because when extra expenditure of nervous energy is necessary to maintain perfect binocular vision, asthenopic and reflex symptoms occur, quite as annoying as those due to errors of refraction.

Muscle-deviations are almost always due to a refractive error. It was long supposed by some that the defect was anatomical; that the muscles concerned were too short, too long, or wrongly inserted or attached; and that the only remedy was surgical operation; to cut

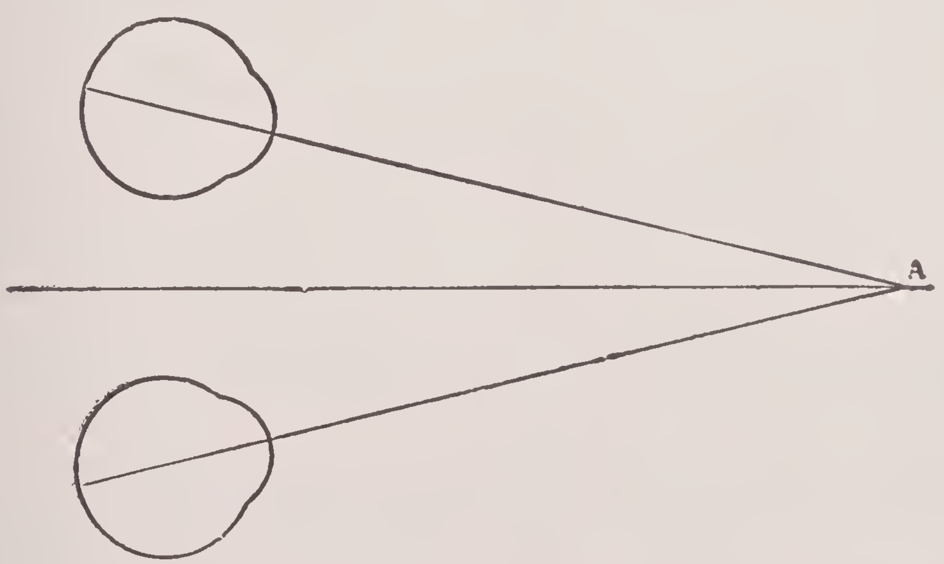


Fig. 124. Diagram to show the eyes properly "converged," so that the axis of each is directed toward the object, A, which is looked at.

the tendon or shifting it to a place where it would let the eye be "straight." We know now that all cases of muscular deviation not the result of paralysis, require proper glasses as the first treatment. In young children the squint will usually disappear after the glasses are worn a short time, but if correction of the ametropia and proper

exercises do not establish muscle-equilibrium after several months, then the surgical measures may be tried.

The involuntary, or automatic, movements of the eyes, such as turning in reading, are intimately associated with accommodation. For instance, when a book or paper is brought close to the eye the ciliary muscle receives a nerve-impulse, forcing it into action, thus changing the focus of the crystalline lens, so that it will receive rays of light from the near object and focus them exactly upon the retina. At the same time the two eyes must **converge** in order that their visual axes shall meet exactly at the near object; otherwise there would result diplopia, two images, which could not combine into one in the brain. In the same way the eyes must be rotated in or out, up or down, with a definite exactness, according as the object or the attention is moved to the right, left, above or below the vertical and horizontal visual planes, so that the visual axes may meet exactly at

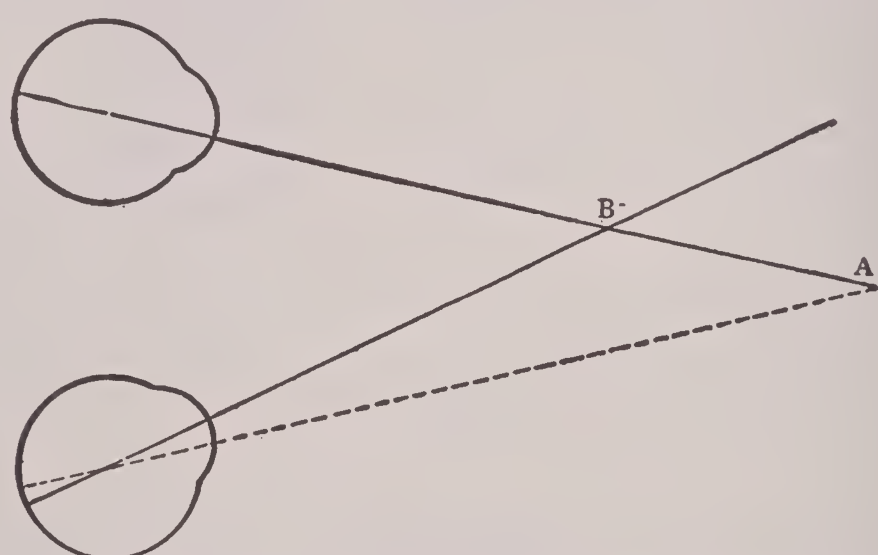


Fig. 125. Diagram showing the position of the eyeballs in squint (or strabismus). The eyes are "accommodated" for the object A, but "converged" for B. This is usually due to "far sight." Notice that the object looked at is further away than the point to which the eyes are converged.

the point of observation and we would see double. These movements of the eyeball are intimately associated by habit, and are likely controlled by one center or contiguous centers, as far as participation in near work is concerned, and moreover there is a constant relation maintained between accommodation (or change in shape of the eye) and movement of the eye as a whole. Thus the amount of accommodation and of convergence are normally proportionate—to look at an object near by requires a certain amount of accommodation of **each** eye and a corresponding degree of convergence of **both** eyes, and long ago the theory that squint is due to excessive convergence, associated

with excessive accommodation in hyperopic eyes, was propounded, and has never been disproved. The same is true of muscular imbalance. Attention to the error of focussing often speedily relieves the muscle disorder. It is careful correction of the vision, and not surgical operation, that prevents or cures most of these cases. Should muscle balance be established by an operation the uncorrected eyestrain, which was the cause of the cross-eye or squint, would remain and be still operative, and unless corrected by glasses there would be a recurrence of the deviation, or equally serious reflex symptoms of eyestrain would ensue.

Oculists use mydriatics, or "drops," as they are popularly called, in measuring the refraction of the eyes to produce **paralysis of the ciliary muscle.** So long as the accommodation is left active in far-sighted and astigmatic persons, it is impossible to discover the full degree or kind of the defect on account of the continual compensatory action of the ciliary muscle. By using a substance in the eyes which paralyzes the ciliary muscle and puts the eye in a state of rest, the interference of accommodation is removed. A far-sighted or astigmatic person, who has perfect vision when the ciliary muscle is active, will see as poorly at distance, when his ciliary muscle is paralyzed by a drug (mydriatic) as an equally near-sighted person, as there is no ability to strain or compensate left, the full amount of the defect is unmasked. Without a mydriatic, far-sighted and astigmatic persons do not show the full amount of their error, while near-sighted persons are liable to select glasses too strong for them. Or, in other words, in fitting glasses it is very hard to get a patient to refrain from using his accommodation. When the accommodation has failed in old age a mydriatic is not necessary, but it is a safe rule to follow, always to use a mydriatic in the first examination for glasses in persons under forty-five years of age, and often ciliary paralysis is necessary for accurate refraction (estimation and correction of errors in focussing) of robust patients of even fifty years. Persons advertising to examine the eyes of children and young adults accurately without the use of mydriatics claim what is impossible even to the skilled oculist.

There is an eye disease of middle and later life, called **glaucoma,** in which the use of a mydriatic may produce very serious results; and opticians, jewelers, and other non-medical "refractionists" are forbidden by law to use "drops." This disease is, however, very rare, and is readily recognized by a competent oculist, who always makes careful examination before using a mydriatic or ordering glasses. Although there is no danger from the use of "drops" by the skilled

physician, their ignorant use by itinerant opticians, jewelers, peddlers, and the like, is a serious menace and may result disastrously to persons with glaucoma, who, owing to their failing vision, are particularly likely to be seeking a change of glasses.

Tests for the Eyes.

Testing the Sharpness of Vision.—It has been proved that the smallest perceptible retinal image corresponds to a visual angle of 5′, or 1-12 of a degree, which is 1-360 of a circle. On this principle, **test-types** have been constructed in such a manner that every letter is so made that when at its proper distance it subtends an angle of 5′. The letters in the figure here given subtend an angle of 5′ when placed about twenty feet from the eye, and should be read easily at that distance by the normal eye. For children, and people who cannot read, a card with characters such as in the second figure may be used, the patient being asked to tell which way the prongs of the E point—upward, downward, to the right, or to the left.

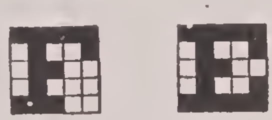


Fig. 126. Examples of Snellen test types, which are made of a definite size and heaviness of the lines.

Fig. 127. Examples of test types for people not able to read. They tell which way the arms point.

For testing distant vision a series of test-letters is made use of, so arranged that they subtend an angle of 5′ at distances varying from 10 to 200 feet. The distance may be given in meters. These cards may be obtained cheap at any optical store. The two figures above, placed at 20 feet distance, may be used by the reader for the simple purpose of finding out whether or not his vision is normal. Always examine each eye by itself, while the other one is covered.

If the patient is young or is not compelled to use his eyes closely in his daily vocation, and complains of persistent eye-pain or headache that is not traceable to other causes, the eyes should be put at rest under atropine for ten days, and then tested. This is done by putting one drop of a 1 per cent solution of atropine into each eye three times daily for two days. If the vision becomes less acute under the mydriatic, or if the symptoms complained of are relieved, the diagnosis of eye strain is made.

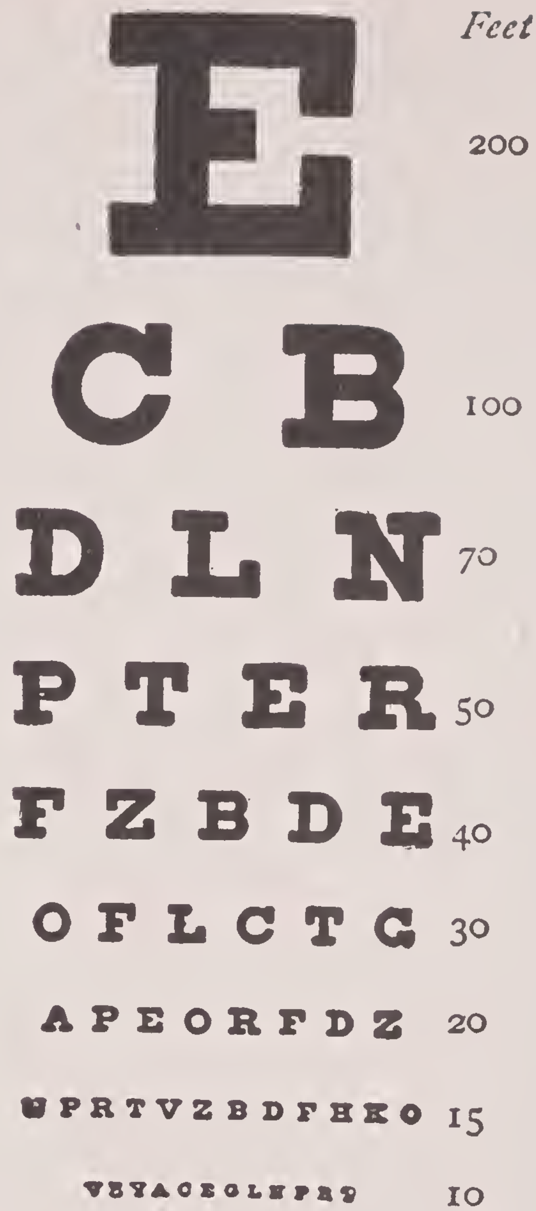


Fig. 128.
Chart for testing the vision. One eye is tested at a time, the other being covered. The letters should be read at one-fourth the distances here given, as this is one-fourth the size of the regular chart.

To Test Accommodation.—The page is to be brought slowly up before each eye separately, while the other is covered, and the following is to be read as soon as it is well seen:

> Measures preventing the development of myopia consist in the careful examination of children's eyes, particularly about the time they are to start to school, and in securing the best hygienic conditions for them during their school hours.

People younger than 21 should be able to read the type easily at from 5 to 7 inches distance, otherwise there is considerable hyperopia or some extra disturbance of the ciliary muscle, and an oculist should be consulted. Middle-aged people who cannot see the type easily at 10-12 inches are either presbyopic or hyperopic, and are in need of

reading glasses. If there is a difference in the reading power of the two eyes, the case is especially one for an oculist. If one has very poor distant vision, but can read the above type easily at 5 inches, he is myopic. If reading glasses are already being worn and the type cannot be read with each eye at 10-12 inches, the glasses are not strong enough. If the type cannot be read with the glasses, at a distance of at least 14 inches, the glasses are too strong.

Color-blindness.—Total color-blindness is very rare. In such cases all colors appear grayish. Partial color-blindness is generally congenital. It is often hereditary, and sometimes skips several generations. The discoverer of color-blindness was Dalton, a distinguished professor of chemistry, who himself was color-blind, a condition which he learned by accident.

Color-blindness may be the result of disease or of accident. It often appears after disease of the optic nerve, and is a particular symptom in excessive use of tobacco or alcohol.

Partial color-blindness is quite common, especially among males, in whom the proportion is 1 in 25 (i. e., one man in twenty-five is color-blind), while it is 1 in 400 among females. There may be blindness to blue, yellow, red, or green. The colors that most often fail to be properly recognized are red and its complementary color, green. These colors do not appear absolutely black, but they cannot be distinguished from one another nor from certain shades of gray and brown. In extreme cases there is total inability to tell red from green, even the brightest shade of red not being distinguished from green. Unfortunately, the colors most often at fault are those that have been selected by railroad companies and navigators as signal colors; hence, it is most important for the employees of transportation companies to have the color-sense absolutely perfect.

In the ordinary **Holmgren test,** the person is given a test-skein of wool of a light-colored pink, and told to select (without naming) from a mass of similar skeins those which most nearly resemble the skein to be matched. If he is color-blind, he will confuse and pick out the grays, the greens, the pinks, the browns, and the reds. As a confirmative test he is then given a light, pure green skein to match in the same way. The examiner must not be at all color-blind.

A convenient apparatus to test for color-blindness, which has been widely adopted by railroad examiners, consists of a stick to which numerous bundles of yarn are attached. A light green is used as the test-skein. The method of using this **Thomson stick** is as follows: The patient under examination is asked to match the light

green test-skein from the yarns on the stick, which are arranged in alternate green and confusion colors, and which are numbered from one to twenty. The selection of ten tints is required, and the examiner notes the number of the tints chosen. The odd numbers are green and the even ones are the confusion colors. If the patient has a good color-sense, his record will contain none but odd numbers; if he is color-blind, the mingling of even numbers shows the defect. To distinguish between green-blindness and red-blindness, the **rose-test** is used; the color-blind patient will select, indifferently, either the blues intermingled with the rose, or, perhaps, the blue-greens or grays. Lastly, the red test is made as a confirmation.

There are other color tests, but these two are sufficient for practical purposes. The field of vision for different colors is tested in the same manner as described before for vision of any kind, using a colored object instead of a white one.

The General Care of the Eyes.

The care of the eyes in earlier childhood is very important. From the moment of birth the eyes should be thought of and cared for.

Ophthalmia neonatorum, a disease appearing between the first and third days of life, and commonly known as "babies' sore eye," causes many cases of blindness. The moment the appearance of any inflammation of a child's eyes occurs during the first week of life, a physician should be called, and his directions as to repeated cleansing should be thoroughly and rigorously carried out.

Infants' eyes should always be guarded from the direct glare of the sun, either indoors or outdoors. When out in its carriage it should be protected, when lying down, by a parasol, preferably lined with some dark-colored material that will absorb the light. Young children should not be given toys that require close inspection. Blocks letters, or picture books should be so large as to be easily seen at some distance from the eye. Even very small infants are better out of doors on a clear day, and when they can walk, they should be romping about in games or looking at distant objects, rather than using their eyes at close range. Much general physical exercise and little ocular and intellectual labor are desirable in young children.

As the child grows older and has playmates or schoolmates every precaution should be taken to prevent its infection from granular lids and acute conjunctivitis ("pink eye"), as well as from other contagious diseases. The child should be told of the danger and repeatedly and clearly cautioned about it. It must not use the same towel,

handkerchief, or drinking mug that is used by its companions, no matter how healthy these may be, and it should especially be forbidden and prevented from playing with children who have "sore eyes."

Dangers of the School.—There is a danger in the kindergarten of giving the young children work and play that is suited only for older children. Anything needing prolonged, close use of the eyes, or fine work with the fingers is very harmful to the child's delicate and immature nervous system. Much "nervous weakness" is due to this very mistake of forcing babies to be children and children to be grown-ups.

Very young children should not be given near work to do, and in day nurseries and primary schools the most of the teaching requiring use of the eye should be by large pictures and charts hung at some distance from the pupils' eyes.

If a child has red eyes, or holds its book close, or is not able to see at a distance, as on the blackboard, looks at things sideways or between partially closed lids, or squints or complains of headache, browache, or pain in the eyes, the parents or teacher should at once send it to a competent oculist. If the oculist decides that glasses are necessary, **they should be put on at once and worn,** in spite of any foolish prejudices. They will save the child much suffering and promote its physical and intellectual development, preventing perhaps irreparable disease of the eyes and nervous system.

Young children with faulty eyes or hearing are often thought to be stupid or wilfully inattentive, and are actually punished for physical defects which should have been detected and remedied long before.

"When shall a child begin school?" This, of course, depends largely on the child's health and eyes.

Ordinarily a healthy child with normal eyes may begin school at eight years of age. Of course, if the proper precautions, explained later on, are observed, the entrance age may be lowered somewhat. No child of tender years should take part in prize competitions; it might be better if there were no grading in the primary schools other than by term average. The ambitious parents often ruin a child's eyes and health.

If the eyes are defective systematic study should not be started until later than usual, when the eyes are more able to resist the possible bad influences of much use. In the meantime the child should

be instructed at home or in shortened courses at school. Outdoor exercise and proper manual labor should be allowed.

Care of Children's Eyes at Home.—Continuous close work is very injurious to the eyes of children. Sometimes parents allow the evils of school life to be continued at home. Proper lighting and seats are not thought of. Children are sometimes allowed to read story books and novels as much as they please, and until late at night in a poorly lighted room or in front of a fireplace, and very often in a stooping or recumbent position. Such children are generally over-ambitious in school, and not only should take regular and definite intervals of rest from close work during the day, but also should be discouraged from much, if any reading, writing, or sewing at night. If home study is necessary, the proper lighting, chairs, and desks or tables should be provided.

That modern school life is often most injurious to the eye as well as to the general health is not sufficiently recognized by parents and teachers. Nearly all knowledge is acquired more or less by the use of the eyes. If the proper care of the eyes is not observed, the evil effects of eye strain upon the whole body may be most serious, **even when the eyes are normal.** With the advance of civilization there is a constant increase of ocular and general physical defects among school children. The chief causes are imperfect construction of school houses (imperfect lighting, foul air from crowding and poor ventilation), long hours of close work in school and necessary extra preparation after school hours, frequent and difficult examinations, and poor print in school books.

There has usually been a disregard, on the part of public authorities and educationists, of the advice of physicians in matters of public hygiene. Happily this is changed by the efforts of the intelligent mass of the community and the philanthropic efforts of the physicians themselves, who often give advice and time willingly and gratuitously. All persons seeking election as school directors or trustees, superintendents of schools, etc., should be subjected to a non-partisan examination in the principles of school hygiene.

Physicians should be engaged to examine the eyes as well as the general health of every school child before entrance on school life, and the children should be carefully supervised as to their health during the early school years, while the teachers should be instructed in all the elements of school hygiene.

The Development of Eye Defects in School Children.—The eyes of a child at birth are hyperopic and ill adapted for close work. The

tissues are delicate and soft, and excessive near-work by young children is almost certain to cause more or less eye disease, which is not only easily induced at this time, but is permanent and tends to get worse and worse. It is not "outgrown."

Most school children's eyes are defective and generally astigmatic; the hyperopic eyes are more common than the normal or the myopic eyes, particularly in early school life. In the higher grades of school marked short-sightedness, often with disease of the choroid, becomes more and more frequent, until the proportion of near-sighted eyes in some of the higher continental universities is as high as 50 per cent. Strange to say, myopia developing in the primarily hyperopic eye, seldom results in a normal eye, the disease progressing from hyperopia to myopia, as has been aptly said, "through the turnstile of astigmatism."

School Hygiene.—The importance of eye-strain and bad eyesight on the intellectual and physical development of children makes it advisable to discuss separately each of the chief faults that are found in modern school systems.

The location of a school building should secure the best sanitary environment, if possible on a wide street, remote from any high buildings, if possible in the center of a lot large enough for a surrounding playground. Ocular defects are always more numerous in schools on narrow streets or close to high walls, and children on the lower floors of such school houses have the worst eyes. There is also much less myopia in the primary schools of rural districts.

The light should enter the room directly from the sky, and not by reflection from an adjacent wall. Northern light is the most constant, but the hygienic advantage of having the sun in the rooms during some portion of the day, as afforded by the other exposures, is important. Excessive sunlight may be controlled by the use of awnings and shades. An oblong room allows better lighting than a square room.

The character of the light in a school room may be estimated by observing from the various parts of the room how much sky can be seen and in what direction. The intensive colors, etc., of the room are as important in regard to the light, as the outlook is.

The windows should be numerous and large, with large panes of glass, which should be kept clean, and should be so placed that the light may come from the left or from the left and rear of the desks. Light coming from the right produces injurious shadows of the pupils' hands and arms on their books and papers. Light coming

from the rear is obstructed by the pupils' bodies and also causes shadows. Light from the front is the worst of all, and may be so dazzling that it greatly embarrasses vision. One need only look at a picture hung between two windows to realize this. Overhead or sky-lighting gives excellent illumination, but it is practicable only on the top floors. It also contributes much annoying heat in warm weather and interferes with proper heating in the winter. Cross-lighting by windows on opposite sides of a room is very objectionable as it causes confusing shadows.

There should be at least one square foot of window space to each four square feet of floor space. But there cannot be too much window space, as excessive light may easily be controlled, while artificial illumination is the only remedy for insufficiency of daylight. It must be emphasized that the lower floors require the largest window space.

The dimensions of the ideal school room are as follows:

	Feet.
Height of ceiling	15
Length of room	32
Width of room	24
Pier or blank wall, rear of room	4
Pier or blank wall, front of room	4
Space allotted to group of windows	24
Window-sill from floor (beveled)	3
Top of window from floor	14
Height of window	11

This gives a total capacity of 11,520 cubic feet, or 256 cubic feet for each of forty-five pupils.

The window-sills should be at least four feet above the floor, for the larger pupils, so that the light will come over the pupils' heads. Light coming in below is worse than useless, and must be shaded. There should be no more wall-space above the windows than necessary, and the sills should be beveled to admit the maximum amount of light, or, in other words, the window-sill should slant down from the sash, so that it does not cast any shadow itself, and the window frame should flare out to the wall-surface.

The window-shades should be the ordinary Holland style, either light gray, buff, cream, yellow, light blue, or green. There should be two for each window, so that the upper or the lower half of the window, separately, or both, may be shaded as desired.

The walls and ceilings of a school-room should be of some light color, such as advised for the shades. Colors near the red end of the

spectrum, such as terra-cotta, absorb too much light. Light-colored woods, such as oak, are preferable to walnut and other dark woods for the doors, window-frames, book-cases, etc. There should be as little wall decoration, such as charts and pictures, as possible, and a minimum of blackboards.

The efficiency of the lighting may be easily tested by small print read in the remotest corner of the room on a cloudy day. Artificial lighting should never be needed during school-hours.

The desks and seats should be so arranged in relation to the windows that the light comes from the pupils' left or from the left and behind. The desks should never face the windows. Some arrangement, too, must be made so that the teacher will not confront the direct glare continuously. The desks and seats should be adjustable to children of various sizes. It is very wrong for children of all sizes to sit at a uniform-size desk.

The common faults in school-desks are unsuitable **shape of back,** too great a **distance between seat and desk,** disproportion in the **height of seat and desk,** and incorrect **shape and slope of the top of the desk.**

The edge of the desk should project slightly over the edge of the seat. The top of the desk should incline downward about ten degrees toward the student from the horizontal, and it should be low enough to allow the forearm to rest on it without raising the shoulder. The seat should be sufficiently broad to support almost the whole length of the thigh, and low enough to allow the whole length of the sole of the foot to rest on the floor. It should be slightly concave, to prevent slipping, and horizontal rather than sloping. The back of the seat should be so curved forward as to support the loins sufficiently and to make it easy and comfortable for even weakly children to sit upright.

If the seat is too high, the child is uncomfortable and cannot touch the floor with his feet, and therefore does not get proper aid from the legs and feet to maintain an upright position, but has to bend forward (curving the spine forward). If the desk is too high, the elbow can only rest by curving the spine laterally and raising the shoulder. The work is also brought too close to the eyes and causes extra strain on them. If the desk is too low, the child must stoop over the desk and becomes round-shouldered. This position also puts great strain on the accommodation of the eye and compresses the superficial veins of the neck, causing ocular and cerebral congestion with its pernicious consequences.

Blackboards, charts, and maps are valuable in teaching children, because information may be imparted at a distance by them and the strain of accommodation in near work dispensed with. All figuring or lettering must be large enough to be read easily from any part of the room, and the charts, etc., should be hung so that every pupil can see them square or nearly so. Even to those with fairly good eyes, such characters, to be read at a distance of forty feet, should be at least one and one-half to two inches high. The same precautions should be observed in regard to writing on the blackboards. If, when all these requisites are observed, a pupil fails to see the contents of charts, maps, or blackboards from any part of the room, it is certain that he has a serious error of refraction or disease of the eye requiring immediate medical attention. Blackboards should be kept clean with sponge and water, and as dark and as free from gloss as possible. There is not sufficient contrast of the white chalk on a very dirty grayish-black board, which has been cleaned only with a common eraser. White boards with black crayons, although affording a better contrast, soil the fingers so much as to be impracticable.

Copying from the blackboard should be limited as much as possible, as it is very trying to the eyes on account of the constant change of focus in looking from the desk to the board and from the board to the desk again. Blackboards and charts should never be placed between windows, but always opposite the windows.

Slates are unclean and unhygienic. They also usually afford too little contrast. Pencils or pen and ink and dull white paper are suitable substitutes.

Regulation of Study.—In the lower grades especially there should be such regulation of the studies that reading or writing after school-hours is unnecessary. The studying should be done within school-hours. The curriculum should be so arranged that wherever possible oral instruction and demonstrations with maps, charts, or blackboards alternate with study from books. The curriculum of primary schools should be so elastic that pupils in poor health or with defective eyes may take only a part of the full course of instruction. Prize competitions and term-examinations should be done away with in the primary schools. Suitably frequent intervals of rest, such as are afforded by conversations, lectures, and recesses, are very desirable. One daily session of two or three hours is sufficient and best for the smaller children.

Medical examination of school-children is highly desirable. Every

child should show a medical certificate of good health and satisfactory vision before being allowed to enter school at the beginning of each term. The teachers might be instructed by the school physicians in the elements of medical examination and in the simple tests for hearing and vision. Children with faulty eyes should be sent to an oculist or to an eye hospital for treatment and for advice as to the wisdom of continuing their studies; such pupils should also report to the oculist from time to time, so that he may keep their eyes under supervision.

School-books should be small enough to be easily handled, and ought to be printed on dull-surface paper, in type large enough to be read easily. Cohn insists that in schools all books should be excluded that contain type smaller than long primer (10-point) and have less than one-tenth of an inch space between the lines. The lines should not be over four and one-half inches long, nor contain more than sixty letters.

The following statements apply to all books and papers, whether for use by school-children or by others.

Type.—Heavy-faced type is the easiest to read. What are known as 8-point type and 10-point type (a point being one-seventy-second of an inch) are commonly used in printing. Finer type necessitates strain on the accommodation, and requires the page to be held too close to the eye. Coarser type increases eye work, as it covers so much more space, and often lengthens the columns and lines. This book is printed in long primer type, which is excellent for comfortable reading. Latin letters are greatly superior to Gothic, and the Germans are fast substituting it for their trying type in magazines and books for study and scientific reference.

Leading between the lines and **spacing** between the letters are of great importance in regard to legibility. There should be about one-tenth of an inch between the lines of type. Such a spacing is used on this page. The contrast between leaded and solid type is seen in the following paragraphs in 8-point type, the first being leaded, while the second is solid:

Every one who has used a lens or magnifying glass is aware that in order to see an object distinctly through it, it must be kept at a certain definite ''focal'' distance from the object: the same law applies to the eye; its lenses are so regulated, that the focal distance of most healthy, well-formed eyes is the convenient distance of about ten inches; in other words, in order that an object such as print may be distinctly seen (that its image may form a distinct picture in the retina of the eye), it requires to be placed at the above distance.

Every one who has used a lens or magnifying glass is aware that in order to see an object distinctly through it, it must be kept at a certain definite "focal" distance from the object: the same law applies to the eye; its lenses are so regulated, that the focal distance of most healthy, well-formed eyes is the convenient distance of about ten inches; in other words, in order that an object such as print may be distinctly seen (that its image may form a distinct picture in the retina of the eye), it requires to be placed at the above distance.

The length of the line is of great importance. The old quarto page should be discarded. No line should be longer than four and a half inches; and in large books it is much better to divide the page into two or even three columns with an appropriate blank space between them. The long lines necessitate extra rotation of the eyeballs, and are therefore fatiguing to the eye muscles.

Paper used for reading matter should not be glazed nor have a glaring white surface. A dull surface of some slight neutral tint is best. It is, of course, necessary to use **good** paper and **good ink** and good type to get clear printing. Paper should be opaque, but this does not necessitate thickness and consequent weight and expense. The high-priced prayer-books and small bibles are usually printed on very thin paper.

The worst offenders in regard to unsuitable paper are the two extremes—the newspapers, which use coarse paper, indistinct impressions, blurred ink, and small type, and the high-class illustrated magazines and books, with a highly finished, glossy surface necessary for the popular half-tone illustrations.

The style of writing taught is of less importance than the arrangement of the desk and seat which give the best position for the pupil. So long as the upright position is maintained and both eyes are equidistant from the paper (i. **e.**, the paper in a central position looked at straight) it makes very little difference whether vertical or slanting writing is practiced. The pupil may perhaps be allowed to evolve his own system of penmanship if the requisites of a right position are complied with. It is held that vertical writing is much easier taught and is more legible. The belief that it is less likely than the slant system to cause astigmatism is based purely on theoretical grounds.

Overuse of the Eyes.—The eye is one of the most obliging organs in the human body, and under favorable conditions will do an almost unlimited amount of work; people often tax their eyes far more severely than they would think of doing in the case of any other structure. In fact, it is popularly believed that if the eyes are healthy, reading, sewing, and other near work are **passive** acts

for the eye, that the eye is untiring, and never becomes exhausted. This is especially true if glasses are worn, for then the patient is more than likely to blame his oculist if his eyes pain when over-worked. Persons whose occupations involve much use of the eyes should vary their duties with intervals of rest or of entire change of employment. The clerk who is tied to his desk all day should seek recreations after hours that do not require close eye work. In long continued reading and sewing, it is well to desist at short intervals and fix the gaze on some distant object and also to close the lids for a minute quite often. The sensible person so regulates his duties and recreations as to give his eyes much-needed rest.

Artificial Lighting.—Much of the eye-work of today is done under artificial illumination. Most persons are so busy during the day that much of their reading, sewing, writing, and other near work is done at night. This is particularly true during the winter months, when the days are short. An "evening at home" generally implies for both adults and children an evening of using the eyes. The amount of eye-work done today is greatly in excess of that of our forefathers' time. The scarcity of books and newspapers and the poor light, often only the tallow dip or open fire, prevented the people of the olden time from reading at night. Now artificial light is so good, and books, magazines, and newspapers are so abundant and cheap, that the habit of reading has grown to enormous proportions.

In view of all these facts the proper understanding of artificial lighting becomes of great interest and importance. The main means of artificial illumination are kerosene, gas, and electricity, any of which, when properly employed, is satisfactory. The nearest approach to a perfect light is that which most nearly resembles diffuse daylight. Such diffused lighting by artificial means is not yet practicable in dwellings, and the best that is generally obtained is to have several lights.

The principal considerations in artificial lighting are the quantity and quality of the light, including its steadiness, the vitiation of the atmosphere by the products of combustion, and the expense.

The proper arrangement of lights in dwellings, school-rooms, stores, and workshops is often neglected. A large family often gathers about a single gas-burner so placed that those most remote from it do not get nearly enough light. This is remedied in ordinary dwellings by having enough lights to allow each reader sufficient illumination without interfering with any of the others. In assem-

bly-rooms, stores, workshops, etc., these difficulties are not so easily overcome.

The proper arrangement of the lights is often very difficult. The light may in some cases be distributed from overhead by reflectors, which also may act as ventilators. In ordinary cluster arrangement equal distribution is impossible. Those nearest the light receive the most light, but suffer from the radiation of heat, and in many parts of the room annoying shadows are cast.

Indirect illumination, by throwing part of the light on suitably colored walls and ceilings from which it is reflected diffusely into the lower part of the room, has been used successfully, and deserves more attention than has been given it by architects and builders.

Kerosene, or coal oil, is the principal illuminant of rural communities and among the middle and lower classes in towns. Its cheapness is the great point in its favor. The steady light of the modern lamp when properly shaded by a slightly bluish chimney or shade to absorb the excess of yellow rays is very satisfactory, and, in fact, is preferred by many over all other kinds of illumination. The principal objections are the heat, the odor, the trouble of filling, keeping clean and lighting, the danger of explosion and fire if upset, and the vitiation of the atmosphere. Two or three persons in a large, well-ventilated room may be comfortable with a coal-oil lamp, but in a large assembly-room in which are many people and many lamps, some of which are always smoking, the heat and the vitiation of the atmosphere are great objections.

Illuminating-gas is a great convenience, but has ruined many eyes. As usually furnished in cities, it has a great excess of yellow rays, which are very injurious to the eyes. The flame of the old-fashioned "fish-tail" burner, continually flickering in every current of air, is a most objectionable form of lighting; yet for years many families have read by this means. The vitiation of the atmosphere is very considerable in gas-combustion. A gas-jet should burn without any sound and should have a rounded and perfectly steady flame. The tip should be cleaned whenever the flame becomes notched or tailed. Coal-gas is a dangerous poison and more expensive than kerosene, but does not generate so much heat and is very much more convenient. The principal improvements in gas-lighting are the "Argand burner" and the mantle burner, in which a "mantle" is heated to intense incandescence by a Bunsen flame.

The Argand burner is very easily regulated, giving an excellent

light, especially when properly shaded. If, however, lacks intensity and gives much heat.

The incandescent mantle is without doubt the best form of gas-lighting. It gives a white light resembling daylight, and, under proper adjustment and regulation, has far greater volume (60-100 candle-power) than any other gas burner, is not very heating, and does not consume as much gas, and hence is cheaper and does not cause such vitiation of the atmosphere. The initial expense is more than offset by the later saving in gas. It is intensely brilliant, and unless it is shaded with ground glass, porcelain, or like material, it must be placed at a height above the eye. To light a whole room, the burnei should be at quite a height, with a good reflector above it. Holophane globes or reflectors will deflect most of the rays downward.

Electricity is undoubtedly the coming universal means of artificial illumination. **The arc light** is unsurpassed for lighting on a large scale. It is almost colorless, and has nearly the composition of sunlight, its spectrum resembling that of sunlight very closely. It is easily controlled, and is becoming less and less expensive. Any candle-power up to 1,000 may be obtained. It is too dazzling and unsteady for ordinary interior lighting, unless for very large places and very much modified by shading. **The incandescent electric light**, now in general use in the cities of this country, and in many of the suburban towns which have their own electric light plants, is being furnished cheaper each year. On account of its safety and convenience it is deservedly a most popular form of illumination. It is lighted very readily, is almost as portable as a candle, and may be used for decorative purposes. It gives a maximum of light with a minimum of heat, and does not vitiate the atmosphere—a very important advantage. The ordinary incandescent lamp is termed 16 candle-power, but in use it falls to between 12 and 14 candle-power. This is suitable only for individual use, but the amount of light desired may readily be increased to any desired amount by the use of extra lights or by using higher power lamps, even up to 80 candle-power. For these higher powers the wires must be adequate or fire is liable to occur. The annoying glare of the incandescent film may be remedied by an opaque globe or a suitable shade.

Comparison of the different illuminating agents. The following table is taken from the **London Journal of Gas-lighting**, January 18, 1898:

Illuminating agent.	Burner or lamp.	Illuminating power (in practical use).	Consumption of illuminating agent per hour.	Heat generated.	Cost per burning hour.
		Candles.		Calories.	Cents.
Coal-gas	Flat flame	30	14.09 cu. ft.	1.995	1.536
Coal-gas	Argand	20	7.06 cu. ft.	1.000	0.768
Coal-gas	Regenerative	111	14.41 cu. ft.	2,042	1.560
Coal-gas	Incandescent	50	3.53 cu. ft.	500	0.384
Spirit	Incandescent	30	3.48 cu. in.	318	0.480
Petroleum ..	1 1-6 incandescent burner.	30	6.57 cu. in.	960	0.528
Petroleum ..	Incandescent	40	3.05 cu. in.	550	0.240
Acetylene ...	....	60	1.27 cu. ft.	534	0.528
Electricity ..	Incandescent	16	48 Watts	41.4	0.696
Electricity ..	Arc	600	258 Watts	222	3.720

Acetylene gas gives a brilliant, dazzling, white light, and on account of the small amount consumed it is not expensive and there is little effete products of combustion. It is, however, very dangerous and liable to explode, and on account of its strength and portability is chiefly used in bicycle and carriage lamps. It is explosive when mixed with air in the proportion of 1 of acetylene to 26 of air, and is not explosive in the proportion of 1 of acetylene to 4 or less of air.

Prismatic Devices.—In school-houses that for financial reasons cannot be abandoned, and in office and store buildings where land is so valuable that the buildings must be high and contain many inside rooms, the problem of lighting is a perplexing one. Using the eyes continually in an artificial light, the heat and the vitiation of the atmosphere, and the expense of artificial lighting have been discussed above. Any method that avoids or even partly overcomes these difficulties should be earnestly advocated.

Within the last few years there has been placed on the market an excellent device for windows in the form of plates of glass so constructed that they form prisms which bend rays of light from overhead and direct them into a room at any angle. Sometimes curved surfaces are made on one side of the plate and prisms on the other. By these prism plates the light of a deep light-well or of a narrow street between high buildings is so refracted that is will illuminate otherwise quite dark interiors. The prisms may be inserted in ornamental window panes or inclined a few degrees from the vertical; or in cases of cellars and basements they may form a mosaic tiling. These prisms are inexpensive and ornamental, and

are soon paid for in the saving of gas or electricity, besides furnishing excellent illumination. A similar arrangement of prisms is also utilized in glass globes, called **holophanes,** for gas, oil, or other lights suspended overhead. These globes throw most of the rays of light downward.

Hygienic precautions in reading include: 1. The selection when possible of large type, sufficiently spaced. 2. Unglazed paper. 3. Short columns. (These requisites, of course, do not apply to cheap newspapers, but may be had in magazines and books.) 4. Sufficient illumination, and, of no less importance, 5, the position of the reader; 6, the position of the book, and, 7, the relation to the source of the illumination. The best position of the reader is upright, leaning slightly backward, with the head erect, and the book held nearly on a level with the eyes, or if the book is heavy it may be set in a portable and adjustable book-rest or placed on a table or desk and propped up in such position that the top and bottom of the page will be equidistant from the eye. The closer an object or book is held to the eye the more the muscular and accommodative strain. Unfortunately, people commonly read and sew at close range, even when a greater distance would afford sufficiently clear vision.

The proper reading distance is about fourteen inches from the eye; but no type should be used that is not easily read at twenty inches distance. Very near-sighted persons often hold their reading-matter very close to the eye, but yet at the distance of their far-point. Thus they do not use any accommodation, but have to put such tension on their muscles of convergence that serious results may follow. Fatigue of the muscles of the eyeball often produces as marked and uncomfortable symptoms as does uncorrected faulty vision.

The head should be held erect in reading because there is less liability to congestion of the eye when the head is in this position.

The book should be held nearly on a level with the eyes. Keeping the eyes turned down a long time is fatiguing, and there is an inclination to drop the head forward and droop the shoulders before many minutes, tending to round shoulders and contracted chest.

The light should be on a level with the top of the head or above the head, but should not be placed so that it reflects much in case of very smooth or glazed papers. As it is best to have the light come from the left in writing, it is a change to have it come from the right for reading. The use of **eye-shades** is often of great help when the

light must be used from in front, as when several people are writing around the same lamp.

Reading while lying down is a bad habit, and is particularly dangerous during convalescence from illness or when bodily tired. If there is much fatigue or drowsiness close work should be laid aside, for accommodation and convergence are then effected only by continual effort, and much nervous energy is expended. This, of course, is true of a continuation of work of any kind, but people suppose it is just at such a time that they can read and not have to pay the penalty, as they know they would if they were doing any other kind of work. Using the eyes is not recognized as work ordinarily, and, of course, light reading is often recreative and restful under proper restrictions, even when one is very tired. When a person is tired and drowsy there is a constant and natural tendency for the eyes to participate in general rest of the body and for the muscles of accommodation and convergence to relax, and a distinct conscious effort to maintain them is necessary. Instead of the normal muscle-balance, there is often actual divergence of the axes of the eyes in sleepiness.

In the recumbent position there is great strain on the inferior straight muscles of the eyeball to offset downward rotation. There is also usually difficulty in adjusting the book for proper illumination. Again, the head is apt to be in a constrained position, causing ocular congestion. If one has to read lying down, the book should be placed against a pillow where it will be well illuminated and easily supported, and one should lie on the side with the face opposite to the page at a proper reading distance.

Looking upward is more fatiguing than reading in the recumbent position, as any one knows who has gone even for a short time into one of the art galleries. There is a peculiar affection of the ocular muscles in miners, known as **"miners' nystagmus,"** which is caused by the constant looking up while at work lying on their backs in coal-mines. In this the ocular muscles suffer so much from the unusual strain that they become disordered, and there is constant oscillation of the eyes to one side and back again.

Reading in cars or carriages is apt to be injurious to the eyes if there is not a very smooth motion. The constant jolting necessitates frequent and abrupt accommodative changes. Besides there is usually very poor illumination in the conveyances. The best railroads have improved these conditions and have supplied sufficient lighting, better roadbeds and better balanced cars with more springs

and have reduced the jolting to a minimum. In jolting cars it is a good plan to use a card placed under the line, moving it down as the reading progresses.

Sewing and embroidery are most trying on the eyes and should be done only under the best conditions of illumination. So far as possible all such work should be avoided at night, and working on **black** goods by artificial light should be absolutely prohibited. Engraving also requires very good light and the eye should be rested frequently. All persons doing fine eye-work and having even slight faults of vision should have accurately fitted glasses.

Veils are bad for the eyes, particularly if they are very thick or dotted. They are often necessary to protect the face, to keep the hair smooth or the headgear in position. A thin veil with a very large mesh will answer all these purposes while interfering very little with vision.

Smoking and drinking in excess so that the whole system is affected will, of course, involve the eyes in the general ill results. Some persons are especially easily and seriously affected by alcohol and tobacco, and often in partial blindness, apparently due to poisoning, the amounts of tobacco and stimulants have not been large, yet when these substances have been discontinued the blindness has disappeared. Such people should, of course, give up both habits at once and entirely, as a special risk is run in their continuance even in a restricted amount. One danger of tobacco-smoke is its irritating action on the conjunctiva when smoking while reading. The smoke may curl about the face and enter the eyes, causing great irritation and blurring of vision. This is more apt to occur in cigarette or cigar-smoking. A long-stemmed pipe is the best to use when reading and good ventilation is also especially desirable.

Relation of the Eyes to the General Health.—The visual apparatus is not a separate organization, but is intimately connected with the whole system. If there is a disorder of the blood, or nervous exhaustion, or perversion—in fact, if there is any serious functional or organic disease—the eyes may participate in the evil. On the other hand, visual defects may influence the whole constitution. Those measures and modes of life which are conducive to general health and vigor are beneficial in maintaining or recovering good health and strength of the eyes. To preserve good vision all through life requires observance not only of the laws of eye hygiene but also of those regarding the general body and mind.

Effect of Spectacles and Eye-Glasses on the Health

Subject Reference

For the Eye, its Use and Abuse, see pages 215 to 266.

HOW TO BUY AND HOW TO WEAR.

Fitting and Care of Glasses. Frequent Change Necessary.

The invention of spectacles has been separately attributed to an Italian, Alexander da Spina; to another Italian, Sylvinus Armatus (on whose tombstone is inscribed, "The Inventor of Spectacles"), and to an Englishman, Roger Bacon, all of whom lived in the thirteenth century. Others hold that spectacles were introduced into Europe through the works of Alhazan, a Saracen, who died A. D. 1038. The Chinese, however, likely used both concave and convex lenses long before this. The writings of Seneca and Pliny seem to show familiarity with some of the properties of lenses. It is said that Emperor Nero was near-sighted and used a concave emerald for assistance in distance vision. The wearing of glasses, however, has become universal only in the latter half of the nineteenth century, and the modern high quality of lenses depends on various mechanical improvements within this recent time. Scientific fitting of glasses was not general until the work of Donders and Snellen evolved a rational method of examining the eyes and prescribing lenses. Before their time it was largely a matter of guesswork.

The legitimate business of the optician is solely to grind and fit glasses. Persons calling themselves "scientific opticians," "refracting opticians," "ophthalmists," etc., who have not even served an apprenticeship to a skilled optician, have not the slightest medical training, and very little if any mechanical knowledge, actually undertake to **prescribe** glasses as well as to sell them. They advertise "eyes examined free," and often travel from town to town styling themselves "doctor" or "professor." It is extremely dangerous to intrust the care of such delicate and intricate structures as the eyes to a non-medical person who, not charging a fee directly, has an interest only in the sale of glasses, which, whether necessary or not, whether proper or improper, are urged on the unsuspecting patient. The optician does not know the minute anatomy and physiology of the eye and its relations with the mind and body, and hence cannot understand ocular disease and therefore is not able either to diagnose or prescribe. He is not versed in the broad science of medicine, on which ophthalmology is absolutely dependent. An optician is never the proper person to prescribe glasses. This is the business

only of the oculist, who is an educated physician, devoting his life to the study and practice of his profession. He alone comprehends the influence of the general systemic conditions on the eyes, and likewise of defective eyes on constitutional disorders. Glasses are sometimes prescribed for definite purposes other than improvement in vision.

The true optician makes no claims other than the skilful grinding and adjustment of lenses. To be a competent workman he also devotes his life in constant endeavor to improve or maintain the high standard of his products. Too great stress cannot be laid on the importance of a good optician. All the careful work of an oculist may be frustrated by careless and incompetent manufacture and fitting of glasses. It is a safe rule to patronize only those opticians who do not attempt to examine eyes, but confine themselves strictly to making and fitting glasses—in other words, purely "prescription specialists." Such charge more for their material and work than the prices advertised by "refracting opticians," but the full worth of the money is in the construction and fitting, and articles bought at the higher price will be cheaper ultimately. Besides, the patient who does not know or is doubtful of the proper charge need not fear imposition, such as is often practiced by "refracting opticians." Reliable opticians alone are recommended by prominent oculists, and they must act honorably or the physician's support will soon be withdrawn.

In general, spectacles are preferable to eye-glasses, and should alone be used when there is much astigmatism, because only the firmness of a spectacle frame will hold the axes of the cylindrical lenses in the right position. If much out of position, the cylindrical lens only aggravates the condition it should correct but does not when improperly held. Many noses are not well shaped for the correct adjustment of eye-glasses. The objections to spectacles are based on esthetic grounds and upon the uncomfortable pressure of the bridge on the nose and of the bows behind the ears. A well-fitted pair of gold rimless spectacles is very much neater looking than eye-glasses pulled out of place by a cord or chain hanging over the ears and face. If heavy frames are ordered and they hurt the ears or nose, they are not fitted properly, and the optician should be immediately consulted and asked to give a right fit.

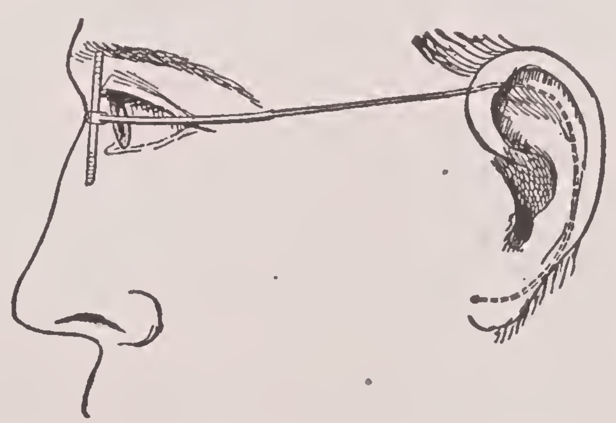
Spectacle-lenses are made of clear flint or crown glass. There is no virtue nor extra durability in the so-called and much advertised expensive "pebble glasses," "rock-crystal glasses," which, as a matter of fact, are usually artificial glass identical with that of the

honest lenses. All respectable opticians use the best glass that they can buy out of which to make their lenses. The cost of the best glass is small, and they could not afford to waste skilled and expensive labor on poor material.

Spectacle-frames are made of gold, steel, silver, or aluminum. The best and most serviceable is 14-karat gold. It has excellent qualities of temper, is readily shaped to fit, is durable, and should always be used when possible. Fourteen-karat gold frames will prove the cheapest in the long run. When they are not practicable on account of expense, the next choice is 10-karat gold, and the third choice is steel. Although steel may rust, it is preferable to silver or aluminum on account of its superior hardness and temper. Rubber and shell have the advantage of being light but are too brittle for spectacle-frames.

Contrary to popular opinion, up to a certain limit the heavier the bridge and temple-pieces of spectacles the more comfortable they are. Heavy temple-pieces are more rigid and keep their shape better, and, once properly shaped, they always fit the nose, temples and ears. Such frames do not hurt the ears or groove the nose. Light-weight frames have little rigidity, cannot be properly shaped, and keep their place by pulling from the nose to the ears, which causes uncomfortable pressure on both the nose and the back of the ears, and also necessitates constant adjustment. The nearest to ideal frames are what are known in the trade as **798½** (rimless) and **718½** (rimmed) **14-karat gold spectacles.**

Fig. 129.
Spectacle frames that are too tight fitting and so do not hold the lenses in proper position.



Fitting Spectacles.—The **bridge or nose-piece** is the foundation of the frame, and if it does not fit right no amount of adjustment of all the other parts will give a satisfactory result. It should lie flat on the nose so that neither edge cuts in at all and also neither edge is turned out so as to be more easily felt than the other in running a finger-tip across it and back; **i. e.,** up and down the nose.

The bridge should be broad enough to rest easily and not indent the skin. The edges should not be sharp. In any subsequent adjustment the original fitting of the bridge should never be altered.

The temple-pieces, or "bows" should be curved behind the ears if for constant wear, but may be straight if the spectacles are used only for close work. They should extend in a straight line from the

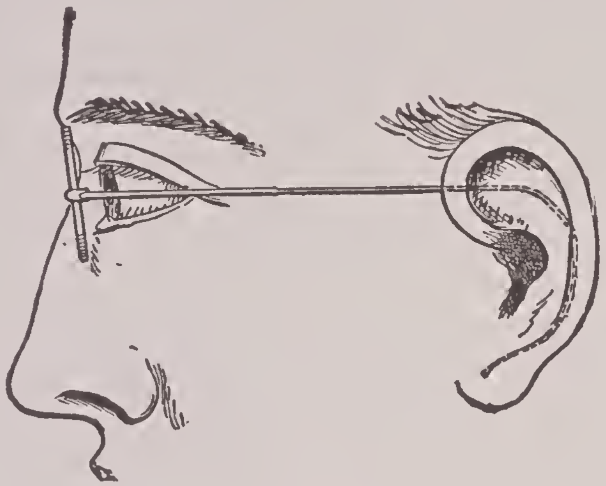


Fig. 130.
Properly fitted spectacle frames.

hinges to the top of the ears. The curve at the top of the ear should be sharp and should conform to the side of the face, neither pressing in nor bowing out, and the hook should be curved to the shape of the back of the ear. The typical careless fitting, or lack of any attempt at fitting, is shown in the figure on page 269. When the bridge and the side-pieces fit properly there is no joggling or shaking of the glasses in walking, running, etc. This is a vital matter and constitutes one of the chief advantages of spectacles over eye-glasses.

The lenses must be of such size and shape and at such a distance from the eyes that they nearly cover the field of vision, so that the wearer does not see over or under or beside them. They must be properly centered and at equal distance from the eyes, matters, which, of course, are dependent on the proper fit of the frame. Improper centering and unequal distance from the eyes often produce prism and other effects so injurious as to offset the assistance afforded by the glasses. This is especially the case in high-power lenses. The edges of the lenses should be ground dull, because polished edges not only cause annoying reflections and refractions but are much more conspicuous.

Position of Spectacles.—The lenses should be slightly inclined forward, so that the upper edge is a little in advance of the lower. Most of the time the eyes are directed slightly downward, and the axis of vision should strike the surface of the lens at a right angle,

and so secure the right combining of the optical action of the eye and the glass. In glasses for near work only the inclination should be somewhat greater, as the eyes are naturally more turned down at close range.

To secure the proper effect from lenses, they should be **worn as close to the eyes as possible.** When very strong lenses are worn any interfering eyelashes may be trimmed carefully and not too closely at short intervals without noticeably altering their growth or action, and to the great advantage of the wearer.

Concave lenses diminish in power as they are moved from the eye, while convex lenses increase in strength as they are moved away. This is why old persons who have worn the same pair of convex lenses for reading during many years gradually push them further and further along the nose away from the eyes.

Care of Spectacles.—In **taking off** spectacles both hands should be used. The temple-pieces should not be pulled widely apart, or otherwise strained so as to wrench, bend or loosen the attachments. They should be carefully unhooked from behind the ears, one side at a time. Some persons simply pull their spectacles off over the ears and weaken the tension and destroy the shape of the bows. In **putting on** spectacles, the lenses should not be pushed against the eyelashes and soiled. The bridge should be placed on the nose about one-third down its length, while grasping the temple-pieces between the thumb and first two fingers near the ear-curve. The ear-curve should then be hooked over the top of the ear without dragging the lenses any closer to the eye; the frame should then be pushed back into position, and, lastly, the side-pieces should be pushed gently down on the tops of the ears.

Spectacles should be folded as little as possible, to avoid making the hinges loose. Instead of folding and putting them in a case each night on retiring, they should be left open, resting on the edges of the lenses upon a shelf, bureau or other article of furniture. Lenses should never be laid down on their face, but always on edge.

Lenses should be **cleansed** as often as they are the least bit soiled or spotted, which may be several times a day. For this purpose an unsoiled unstarched old cotton or linen handkerchief is excellent. Chamois, leather, tissue paper, silk or woolen material, etc., are apt to scratch the surfaces. The cleaning cloth must be kept free from dust and if there is any dust on the lenses it should first be lightly wiped off, as no matter how soft the cleaner, if any hard particles of dust are present, they will surely scratch the surface of the lens. To

clean thoroughly (except in the case of bifocal glasses) use ammoniated water once or twice daily. In cleansing, the frame should be firmly grasped, not by the bridge but at the outer edge, close up to the lens, near the hinge, with the thumb and forefinger of the left hand. The side next the lens being cleaned, and not the opposite one, should be held. If cleansed with improper material or placed face down glasses are liable to remain soiled or be scratched. Should the latter occur, the lenses must be repolished or renewed. Glasses not perfectly clear and clean may not only interfere with vision but also be a cause of unnecessary strain and irritation. In cleaning rimless eye-glasses take great care not to bend or change the tension of the spring.

Reading-spectacles, which are continually put on and taken off, are sometimes more convenient if they have straight temple-pieces, particularly if for women, who have abundance of hair about the temples. Children and persons whose lenses may be exposed to violence should wear spectacles with rims. These are very much less liable to being broken, while the "rimless" are very fragile, breaking on slight cause.

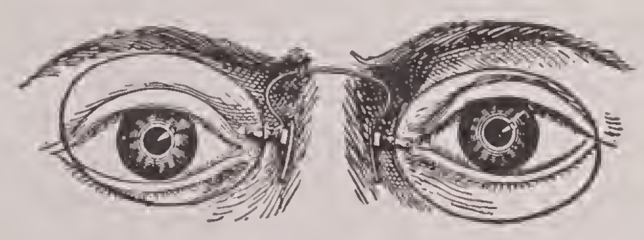


Fig. 131.
Lenses not properly centered. The eye does not look through the center of the lens.

The eye-glass, or "pince-nez," may be used by adults if the lenses are not too heavy or when there is little or no astigmatism, provided the nose is adapted for them. The modern highiy-tempered and thin spring, and the later devised nose-pieces or guards with adjustable

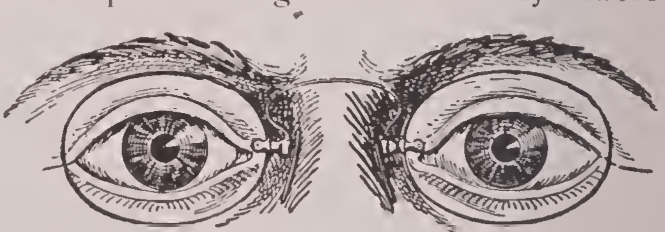


Fig. 132.
Properly centered glasses.

arms or offsets permit many more persons to be accurately fitted with eye-glasses than was formerly at all possible. But even when properly fitted, eye-glasses are apt not to be put on in the same position or place twice in succession; they are easily bent, losing their proper position before the eye, and so by changing the axis of a cylindric lens, particularly, may greatly lessen the optical improvement, especially in high astigmatism. The oculist may fit the glasses

accurately after the most careful and painstaking tests, and yet have his results unsatisfactory, owing to the foolish pride of a patient who insists on eye-glasses when spectacles alone are competent to give relief. Eye-glasses, however, are more conveniently carried about, as they may be hung on a hook on the vest or waist. They may have rims if liable to be dropped, or be rimless, according to the taste of the wearer.

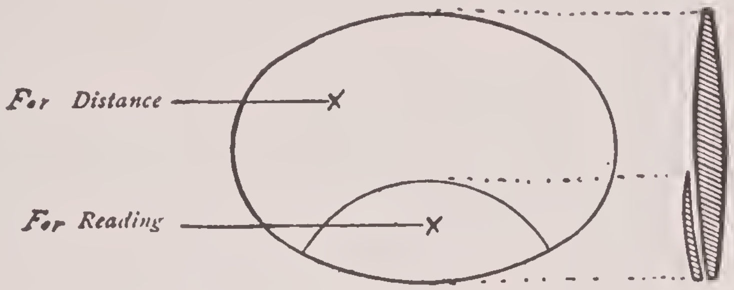


Fig. 133. Double focus or bifocal lens. At the right is shown a section of the two lenses. The eye is turned downward in reading and so looks through the stronger lens (or the combination of the two).

Bifocal Lenses.—Persons beyond middle age with defective eyes need a pair of glasses for reading and another pair for distance. The reading lenses cause a blurring in distance vision, making their wearer myopic, while the distance lenses are unsuited for reading. The greater the age the greater is the difference between the lenses for far and for near vision, because of the progressive diminution in the power of accommodation. Instead of two pairs of glasses to be changed according to needs, "bifocal" (lenses having two foci, really a comb) lenses may be used. The improved form, with a small convex segment cemented on the distance lens, is far more satisfactory than the old Franklin bifocals, in which the two lenses were equal in size and were divided horizontally, and the half of one joined to the half of the other, giving a lens of different foci in its upper and lower halves. The lower segment of the improved form should be about seven-eighths of an inch wide and one-half inch high; the upper edge should be more curved than the lower, as shown in the illustration. The lower segment may be inserted into a notch of corresponding shape in the bottom of the distance lens and placed in rimmed spectacles or eye-glasses (instead of being cemented on with Canada balsam). This gives better wearing qualities if the glasses are exposed to steam or to high temperatures. The neatest form of bifocal lens has the small segment **enclosed** in a deep recess in the large lens, which it exactly fits. The two lenses are made of different kinds of glass. This reveals any crack or exposed edge of the small lens where dirt would lodge.

There is much foolish prejudice against wearing bifocal lenses. They do not hurt the eyes, but when properly fitted actually save them more than the use of two separate pairs of glasses. It takes some little time to become accustomed to bifocal glasses, but they ultimately give greater satisfaction, and are more convenient than two different pairs of glasses. The wearer must be warned and be careful about the danger in going up or down stairs, getting in and off cars, etc., until they have got used to the peculiar effect of the edge of the small lens.

Bifocal lenses need great care to keep them in proper adjustment. They demand greater precision of position than others. Any defect occurring in the cementing of bifocal segments should be remedied at once. The Canada balsam used may be affected by the heat and moisture of the face, and become opalescent and interfere with vision. If this occurs, the lenses should at once be taken to the optician who supplied them for repair.

Trifocal lenses have been used by bookkeepers, musicians and others who use their eyes alternately at the reading distance and at a distance just a little greater, as in copying, reading music, etc. Such lenses are too large to be comfortable and are unsatisfactory. It is much better and cheaper to have a separate pair of bookkeepers' or musicians' bifocal glasses with one focus for reading (fourteen inches) and another of from twenty to twenty-five inches.

In Pantoscopic spectacles only one-half of a lens is used, allowing the wearer to look over them to see distant objects. They are handy for persons who need only reading-glasses, or they may be used as "hook fronts" on distance lenses, really converting these into bifocals.

For persons with only one good eye (as after cataract-extraction, which is usually done on only one eye) **reversible frames** may be used, the lens in one side being for distance vision, while that on the other is for much reading. A bifocal lens is preferable, however, in such cases.

Tinted glasses of any kind should never be constantly used, but only temporarily, as in inflammatory conditions, or during mydriasis, or at the seashore, etc. The habit of wearing tinted glasses is hard to overcome. Photophobia ("dread of light") is a condition in which strong or even moderate light is unpleasant or even painful to the eye. It is usually due to the need of glasses or to wrong glasses. Tinted glasses for constant wear are most used in countries where the importance of correcting eye-strain in comparatively low defects is not recognized. When tinted glasses are necessary, "London-

smoke" **plane lenses** should be used, worn over the ordinary spectacles or eye-glasses and taken off indoors; this is better and cheaper than having the correction ground in smoked glasses. Coquilles generally have some spheric or cylindric effect with an irregular surface. Blue, green or any other colored glasses are much inferior to plain smoked glasses.

On getting new glasses the patient should return to his oculist and have the adjustment examined and the lenses verified by "neutralization" (**i. e.,** by combining them with known test lenses of the opposite kind). Spectacles or eye-glasses may feel uncomfortable for the first few days. Tender places where the frames or nose-guards press the skin may be bathed with witch-hazel and hardened by applying alcohol, cologne-water, or alum-water. Frequent visits to the optician for readjustment are necessary, and for this service the best opticians make no charge. Glasses should never be worn decentered or otherwise out of proper adjustment. The effects that should be obtained from perfectly correct lenses are often spoiled by decentering or other maladjustment.

The prejudice against wearing glasses is happily disappearing in most intelligent communities. Glasses correctly prescribed, rightly made and properly worn are one of the greatest boons possible to humanity. When they are necessary nothing will take their place. Headaches and all other symptoms due to eye-strain will continue until the necessary correction is worn. It is not uncommon for people who have been told of the necessity of wearing glasses to continue to take headache-powders, bilious pills, nerve-tonics, etc., **ad nauseam,** rather than consent to use the only proper means of relief. Generally this is due to inexcusable and false vanity of personal appearance; but occasionally it is owing to the belief that oculists always put glasses on all their patients, or that if one once begins to use glasses the eyes will be weakened and always thereafter require glasses.

The frequency with which glasses are worn now is doubtless due to the spread of intelligence among the people, as well as to the excessive demand of modern life on the eyes. Schools, newspapers, magazines, books and free libraries, have greatly multiplied in recent decades. Artificial illumination has been so improved that reading, sewing and other near work are much more common than formerly at night. Another reason lies in the better recognition of eye-strain in causing inflamed lids, habitual headache, and other more remote symptoms. The advice of an oculist was formerly

sought only when vision was markedly defective, while to-day a large proportion of an oculist's patients are slightly far-sighted or astigmatic and have really excellent vision, but suffer from reflex asthenopic symptoms, the most common of which is headache. Much of the science of ophthalmology and of the refinements in the grinding of lenses and fitting of spectacles and eye-glasses by opticians are of very recent development; these have so reduced the cost of the best lenses that they are now in reach of all who need them. The final reason for the much greater use of glasses now is that an ancient senseless prejudice has been about overcome. When glasses are needed they are almost as necessary as proper rest, and the longer they are gone without the more serious and certain will be the consequences. When their use cannot be given up later, no better proof of the wisdom of putting them on can be offered. On the other hand, it is often the case that by tiding over a threatened nervous breakdown during temporary ill-health, the use of glasses enables the system to recuperate to such a point that they may be discarded, when otherwise either the health would have been lost beyond recovery or glasses would have become permanently necessary.

The proper glasses may not suit at first, and the oculist is often called upon for an explanation or blamed for the failure to get the promised results. In far-sightedness and in astigmatism the muscles of accommodation are so hypertrophied and so active by long years of strain that the lenses giving the full correction as found under mydriasis are rejected when the effects of the drops pass off. In such cases the proper lenses may blur distant vision, and the patient may even see at a distance better without them. But the glasses should be persisted with (just as a disagreeable medical treatment is often pursued), until the accommodation recovers from its abnormal condition and all the objections disappear.

If patients give in to their early difficulties with glasses and wear them only part of the time, the discomfort is only prolonged. If the glasses become quite unbearable, the oculist's advice should be sought again before they are discarded. The above described spasm of the accommodation is only one of many causes for the discomfort of new lenses. The apparent alteration in the size of familiar objects and the false estimation of distances are sources of a certain amount of dissatisfaction; but these are not lasting either and always also disappear in a few days, giving way to delight in the comfort and relief given by the glasses. In such cases such complaints

as "the glasses make me dizzy," "everything seems crooked," "the floor seems too close to me," "the glasses make me nervous," etc., are often made. A little determination and persistence in wearing the glasses continuously will relieve these symptoms if the glasses are correct. It is, of course, also unfortunately true that oculists are human and may make mistakes, but they should be given a fair trial.

The reflections from the glass and the discomfort from the frames are other troubles which soon disappear. Further, persons who have not worn glasses before will continue to turn their eyes instead of slightly turning their heads when looking to one side, and so have confused vision. Some patients, during this early period of annoyance, may happen to pick up a pair of weaker convex or stronger concave glasses, as the case may be, belonging to an acquaintance, and, finding that for the moment they seem to see plainer, may wrongly decide that their oculist has made a mistake. The same false judgment as to when they see best when being "examined free" without a mydriatic in an optician's is the cause of people so often getting wrong glasses from such dealers.

Finally, some near-sighted adults who have never worn glasses for distant correction, although admitting the improvement made by the proper glasses, yet have become so used to the general haze before their eyes, and are able to read so much easier without the glasses, that they refuse to use glasses constantly. These persons should be told of the danger of their near-sightedness getting worse when the proper lenses are not worn, especially if they do much close work—and such people usually have an occupation which is not prevented by the amount of myopia which they already have, and are therefore doing the very kind of work that is dangerous.

Glasses should be frequently changed, particularly in the case of children or youths who are growing quickly. A great difference in the eyes may occur after profound shock, protracted illness, confinement and other depressing conditions. A good rule is to seek the advice of an oculist whenever any of the original symptoms of eye-strain recur or when there is any difficulty with either far or near vision. In the absence of any conscious need of change, it is wise to consult an oculist at least every three years, and so prevent any bad effects which may come on unawares. The necessity of changing glasses to keep pace with the slow but sure changes in the eye is not generally known, and it is common to find an educated person wearing one pair of glasses for many years. Often aged per-

sons use the same reading-glasses for a long time, pushing them further down the nose as the presbyopia increases.

Artificial Eyes.—Persons who have by accident lost an eye or who have had enucleation performed wear artificial eyes with decided improvement in their appearance. Artificial eyes are made of all sizes and varieties of color. In their selection the proper color of the whitish-blue sclera (which varies in shade from that in the pale blonde to that in the dark brunette), the color of the iris, and the normal size of the pupil of the healthy remaining eye are to be matched in the glass eye.

Artificial eyes are usually made of porcelain. They are mere shells, which slip in under the eyelid, covering up the "stump" or tissue remaining in the orbit after removal of the eyeball. It is fibrous tissue, fat and muscles, and may still be movable by the muscles, and so the glass eye may be moved, too, having the same movement as the sound eye so closely that the artificial eye is detected only when the eyes are turned far from looking straight ahead. Recently hollow glass or metal bulbs have been used to replace the lost eyeball and to fill out the orbit.

An artificial eye may be worn after an interval of two or three weeks from the operation if all inflammation has disappeared. It is well to wear it as soon as possible to prevent absorption of orbital fat. The orbit is very tolerant of the foreign body, but, to accustom the tissues to an artificial eye, it should be worn only a few hours at a time for the first few days, making the period longer each time.

An artificial eye is inserted as follows: It is first lubricated with sweet oil or a little good vaseline, and the broad outer end is then slipped under the upper lid, which is slightly raised; the lower lid is then drawn downward by a finger-tip placed on the cheek and the patient is told to look down, and the eye is then gently manipulated into place. Irritation of the stump by an artificial eye may set up inflammation and endanger the sound eye, and must be guarded against. An artificial eye must be taken out at night and washed and placed where it will not be cooled very much nor made any warmer. A new one must be obtained every two or three years, as the glass becomes corroded and roughened and loses its luster and becomes noticeably different from the sound eye.

The Ear and Its Care

How to Avoid Injuries and Affections

FREQUENT CAUSES OF DEAFNESS.

Many Ear Inflammations of Early Life Are Tubercular.

Subject Reference

For the Ear as an Organ of Sense, see pages 68 and 69.

For "Eartire," page 157.

Deafness caused by Adenoids, page 162.

Children's Ear Troubles, page 612, also 642.

The **essential part** of the ear by which the sound-waves are received and conveyed to the brain-centers is placed so deeply as to be out of the reach of direct influences except those affecting the whole body; but the **accessory or conducting apparatus** is exposed to injuries and affections which may be warded off by hygienic rules pertaining strictly to the ear. These rules are mostly "don'ts"—the

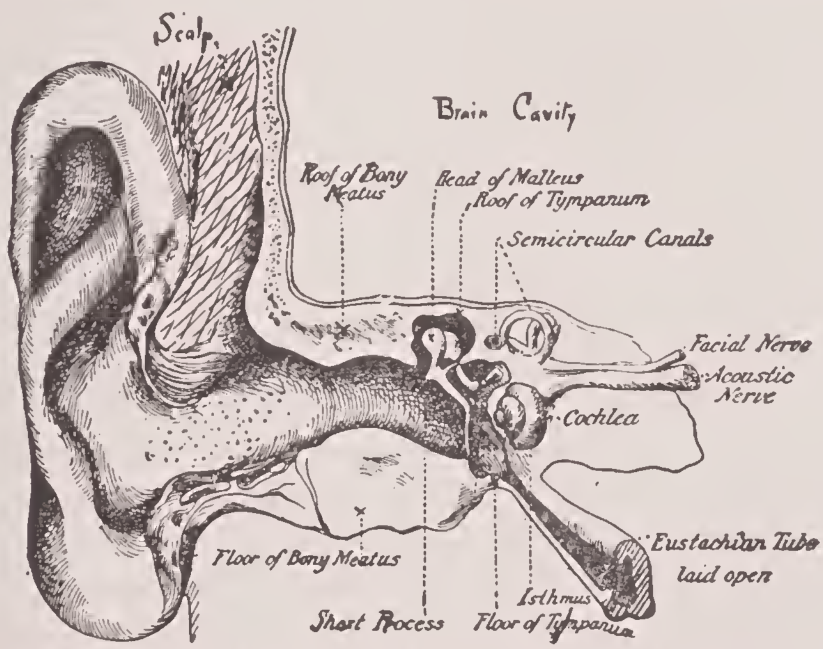


Fig. 134. The ear, shown somewhat diagrammatically. The drum-head is continuous with the malleus bone and should be shown complete across from the short process of the malleus to the bone.

forbidding of common but hurtful interferences—and may be summed up in a brief "let alone," as will appear in the following.

The External Ear.

The Auricle and the Aural Canal.—The external ear is moulded from the skin and its care is governed by most of the rules for the skin and its appendages. The external or outer ear comprises the

projecting **auricle** and the sunk in aural canal, an irregular tube which penetrates over an inch nearly directly inward. Except for its liability to mechanical injury, frost-bite, and skin-affections, the auricle is unimportant, and its complete removal does not sensibly affect the hearing but merely causes an unsightly deformity. Arrested development of it is often accompanied by absence or imperfections of more valuable deeper structures, to which any defect of hearing is really due.

The auricle, as in the case of any other part of the body, should be slowly thawed after **frost-bite.** This is effected by covering it with fur or other good non-conductor to **protect it from warmth** and let the heat reach it slowly. Rubbing it with snow is a good method of slow thawing.

Fortunately, fashion is rather setting her face against the barbarism of wearing **earrings**; but this is little felt as yet among the lower classes, where the tradition that piercing the ears is helpful to sore eyes also persists. This latter superstition is the reason for the not uncommon wearing of earrings among sailors. This is wholly wrong unless a strongly counter-irritating sore is produced. This, however, is an obsolete practice that has given place to more rational surgery. Too often the piercing of the ears has been entrusted to some ignorant and dirty peddler of earrings, and many cases of abscess, more or less severe, result from his use of an infected needle. Severe blood-poisoning may not be usual, but some deformity and suffering is likely to result. Especially in the colored race, a fibrous growth, or "keloid," may result without decided poisonous infection, which may grow even to the size of the fist, and come again in spite of skillful removal by operation. Such ill effects are often ascribed to the earrings being too heavy or made of base metal; and the rings rather than the piercing are blamed for the consequences.

A **blood-cyst, or "hematoma,"** of the auricle is most commonly due to injury in boxing, foot-ball, etc., but occurs also sometimes without known cause, especially in the insane. It has even been held that the occurrence of such a blood-cyst may be prophetic of mental trouble not yet in itself otherwise apparent. Often painless and hard to get rid of, they may leave much deformity, since the cartilage of the ear depends for its nutrition upon the tissues which cover it, and these are lifted off by the effused blood being poured out between them: softening and shrinkage of the cartilage are therefore likely to follow the tardy cure.

The hygiene of the ear-canal is very important. This part of the ear is, in effect, a skin-lined pocket more than an inch in depth, with the **drum-head** at its bottom and its walls containing hairs and glands in the outer portion. The narrowness and curving of the canal help to keep out foreign bodies—even dust being arrested by the wax-covered walls and by the hairs—the so-called **tragi**—which act like a sieve.

The ear-wax, or "cerumen," is secreted as a thin yellowish fluid formed by glands exactly like the sweat-glands of other parts of the skin. It darkens and thickens into a yellow paste as it dries and unites with the little flakes of epidermis and tends to dry, crumble and fall out. As the glands are limited to the outer two-thirds of the canal, no wax forms on or near the drum-head. When found here it has been pressed there by meddlesome interference. All skin-surfaces are constantly shedding the dry dead cells of the outer skin layer; but this should be less perceptible on the fine skin of the ear-canal than elsewhere. Yet the finest scales might interfere with the delicate and sensitive drum-head; by a remarkable provision of nature, however, the cells of the drum-head grow so much faster at the center as to overflow the rest of the surface, pushing the other cells before them over the edge on to the adjacent wall, and even some distance along this before they are thrown off. Thus the drum-head keeps itself clean, and even sweeps the neighboring canal-walls of the cast-off material loosened from them. When the wax gums into scales and crumbs, this dandruff-like material, with the help of the stiff little hairs, which get caught under it, is worked toward the external opening and fall out. The movements of the jaw work upon the outer part of the canal, as is easily felt by the finger thrust into the ear. Large flakes of wax are thus moved outward, or even ejected upon the shoulder. A healthy ear should not show much more than enough wax to render sticky the hairs within it, and the owner should be unconscious of the wax coming away.

Wax does not collect to form a mass in a healthy ear. Nothing should be used to scrape it out, and all devices for this purpose are to be condemned. Yet the entrance of water in bathing, or other unnatural conditions, may gather the wax into masses that do not come away naturally, and collections may thus take place, especially in ears that are not healthy. This may be due to lessened rather than increased wax-formation, although the accumulation may seem astonishingly great when brought to light. Often it is those who, being misguided, take the most pains to keep their ears clean with scoops

or mops that have the largest and hardest masses. Coal-heavers and others employed in dusty work frequently have this condition.

Attempts to remove ear-wax are likely to be dangerous and futile. This should be entrusted only to the skilled physician, although the ease and safety with which the expert removes them may make his fee seem too easily earned. Only those who see how much harm is often done by the inexperienced can realize that the value of such service lies as much in what is avoided as in what is done. Collecting gradually for months until only a small slit through or beside the mass admits the sound-waves to the ear, the entrance of a little moisture or even of damp air may swell the wax enough completely to close all passage-way and cause sudden deafness, with perhaps dizziness, nausea, cough, or other curious and at times most distant and extraordinary symptoms. These symptoms may pass away as the wax dries and shrinks, but return under similar circumstances. Pain is not usually felt unless the mass has been pressed down upon the drum-head, although even then it may be moulded to a perfect cast of the surface of the tympanic membrane without genuine pain, which must therefore be taken as a sign of inflammation calling all the more urgently for prompt and gentle removal by a physician.

The habit of dropping oil or other fluids into the ear "to soften the wax" rather tends to swell the mass and increase pressure without any compensating advantage in aiding its removal, while it is utterly bad as a supposed substitute for removal. Careful, vigorous syringing with hot water (105°-115° F., or what is comfortable to the cheek) is the proper way to remove the wax; no better agent than hot water exists. Yet syringing, like other attentions to the ear, may cause dizziness, or even fainting. The procedure should be discontinued and the patient laid flat on the back at the first sign of such an occurrence. Ear-scoops or mops are allowable only in the hands of a skilled aurist, and he will use them very little. An ear that has been syringed and freed from obstructing wax or other object should generally be dried carefully and protected from air for the rest of the day by a small pledget of cotton just large enough to be retained in the outer part of the canal. On the other hand, the habit of wearing cotton in the ear is useless, uncleanly, and prone to interfere with the proper exit of wax. Often a forgotten plug causes a wax collection that obstructs the canal.

Foreign Bodies in the Ear.—The months or years that objects may remain in the ear unnoticed, or at least without irritation, exemplifies the slight harm that insects, pebbles, or other objects may cause in

the canal. A living insect must be smothered with oil, vapor of chloroform (which can be poured like a fluid from a drop in the bowl of a spoon, or: put a few drops on the corner of a handkerchief and hold it over the ear-opening, the head being turned on its side), or even water, lest its movements cause unbearable distress; but any dead, inactive object is generally unirritating. Children rarely put beads or such objects deeper than the soft outer part of the canal, from which they will easily fall out if the head be tilted to the side and the canal straightened by pulling the ear outward and backward. Great danger to hearing and even to life may be caused by incorrect and panicky efforts to extract objects from the ear. Most of the cases that come to the doctor have been made much worse by meddling; and if he makes judicious use of syringing without obtaining quick success and advises delay, another and more active operator is likely to be sought. Too often some form of forceps is introduced into the ear to draw out the foreign body, and the latter is pressed deeper and wedged in the firm inner part of the canal or actually driven through the drum-head into the tympanic cavity. Similar damage has even been done when no foreign body was present—the wrong ear being worked at or the object having already fallen out unnoticed. No examination or operation should be undertaken without good light. It sometimes answers to let the light fall in past the side of the examiner's head while the canal is straightened by pulling the ear upward, backward, and outward, to give a good view. It should be clearly borne in mind that foreign bodies seldom cause serious harm, even if left for years, unless harmful interference does mischief. The bad results that have been disgracefully frequent in the past would not recur if this advice to "let alone" were followed. Rotary rubbing in front of the ear with the head turned with that side down will often permit a small body to fall out promptly. No other measure besides this and careful syringing should be attempted except by the doctor; for when the foreign body is really wedged fast, it is at times safer and simpler to remove it by a simple surgical operation than to probe blindly in the narrow, swollen canal in which terrible damage may easily be done unseen.

Slight itching of the ear-canal is very common. Eczema may be present or not. It may be of gouty origin. These complaints are important because they provoke the individual to thrust objects into the ear to scratch it, or to drop in oil or other fluids. Such measures are very apt to aggravate the condition; and any break of the skin is easily infected, and a boil or perhaps a series of such abscesses is

the consequence. These may be terribly painful and exhausting, but are rarely serious to life or hearing, as they are situated in the outer ear; yet they are easily confounded with the serious condition of pus in the middle ear and may cause great but needless alarm. Douching with pure water as hot as can be borne may mitigate and perhaps quickly terminate a boil already present; but skilful care is needed to cut short the series of such boils which may occur as the several hair-follicles are successively infected. The inflammation may extend deep into the tissues and involve the periosteum of the bony wall. The swelling may press the ear forward and simulate a mastoid abscess, or the nutrition of the bone may be so interfered with that its decay ensues, possibly with involvement of the deep structures. Such an infection, although "only a boil," is a serious matter.

Whether invisible germs are the cause or only a consequence of such conditions, long experience has shown the high value of antiseptic remedies. At times a growth of mould inside the ear occurs. The diffuse inflammation, with its heat and moisture, is probably first present to furnish favorable conditions for the growth of the mould, and they certainly tend to keep up such conditions by their presence. The occupation and surroundings of patients doubtless are factors in making them liable to such implanting of one or another kind of mould. These growths do not occur in healthy ears, and disappear as soon as dryness and normal conditions have been secured. Dropping oil or other fluids into the ear may not cause such growths as some claim, but it is surely not the best way to treat them when present.

The Drum-membrane.—At the inner end of the external canal is stretched a thin, tense membrane—the **tympanic membrane,** or the **drum-head**—which separates the external from the middle ear. It is placed very obliquely; its lower margin is farther inward than its upper, and the forward is deeper than the back part. This membrane therefore forms the **lower** rather than the **outer** wall of the drum-cavity. The outer layer of the drum-head is continuous with the skin-lining of the canal, but is usually considered with the middle ear, which it bounds.

The handle of the tiny hammer-bone (malleus) is encased in the upper part of the drum-head and reaches down to its middle. The membrane is kept stretched tightly inward in a shallow funnel shape which adapts it to a very wide range of vibrations. The slight thickening due to age causes it to vibrate less readily and impedes the

penetration of high-pitched sounds. Changes in the drum-head due to disease may act similarly and much worse at any period of life.

The drum-head is largely protective, although it also serves as a receiver for sound-waves and aids in conveying them to the internal ear through the chain of little ear-bones (ossicles) connected with it. An opening in it, however, or even its total loss, may hardly impair

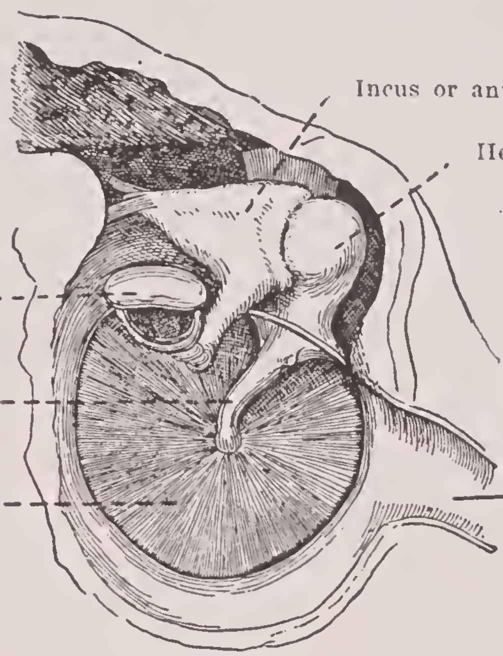


Fig. 135. The ear drumhead (membrana typmpani) as seen from its inner side (looking, as it were, out of the ear), together with the ossicles or chain of bones.

the hearing at all. Low tones are perhaps heard less distinctly, but high tones rather better for its absence. The old impression that hearing depends upon the drum-head is wrong; yet its removal, even when it has become an obstacle to hearing, has not often proved wise. Just as the eyelids are not essential to perfect sight, yet are very important to its safety, so also the drum-head shuts out many hurtful influences and helps to keep the important parts within it moist and pliable.

The drum-head may be punctured by twigs, hair-pins, toothpicks, etc., stuck into the ear; or it may be split by explosions or by a severe box on the ear. Deafness may be extreme after such accidents, but it is the result of the concussion of the parts beyond the drum-head, and it may persist after prompt and perfect healing of any rents in the latter. Most patients with discharge from the ear have an opening in the drum-head, yet may have practically perfect hearing, and such "holes in the drum" are by no means sure to cause loss of hearing nor is their disappearance certain to result in recovery of hearing. Loss or change of the drum-head may give occasion for

the use of an **"artificial ear-drum;"** but, as a rule, only with the effect of tightening relaxed portions of the conducting-apparatus. Such a device is like the bridge of a violin rather than the head of a drum. Most of the much-lauded "patent ear-drums" are not as good as a little pellet of cotton so placed that its pressure will tune up the mechanism without too much irritation. All artificial ear-drums generally irritate more or less, and after short use are best discarded. Any gain in hearing will remain. Most of the advertisements in conflict with this statement are false and misleading. As deafness due to laxness of the parts in question is very rare, the field for artificial ear-drums is very narrow. Like any other foreign body thrust in the ear, they may cause much irritation or damage even in cases where otherwise they would be helpful if properly applied.

Injuries to the Drum-membrane.—Some of the less severe but rather persistent earaches are due to merely mechanical causes. They may be due to higher atmospheric pressure on the outside of the drum-head than within. They are comparable to that due to diving into deep water or entering the compressed air of a caisson or of a diving bell. In the latter case swallowing, or yawning (or by inflation of the middle ear by holding the nose and mouth closed while forcing air out of the lungs), equalizes the pressure and precautions of this sort must be carefully taken in the air-lock on both entering and leaving the caisson. When weakened by disease, small pressure may rupture the membrane, and not only explosions, but a box or other tap on the ear may do this. So too even the slight suction of a kiss on the ear has ruptured the drum-head, and to anyone such a demonstration is very painful. It is also possible that inflation of the middle ear may burst the drum-head from within. Violent coughing, as in whooping-cough, often causes breaking of small blood-vessels or even tearing of the drum-membrane. Violent falls may rupture the drum-head. This is frequent in fractures of the base of the skull, and the flow of blood from the ear tokens a serious and probably fatal injury; yet the tear may be independent of fracture, and the blood may be from the wall of the canal without severe injury to the bone. In rare cases a fall upon the chin may drive the lower jaw back into the ear-canal and cause bleeding from the ear, and possibly rupture of the drum-head. Non-interference and mere protection should be the treatment in all such injuries. Syringing and instillations are likely to do harm, and the experienced physician does only whatever is clearly called for. Such a rupture of the drum-head usually heals after a time, even though it shows no promise at

first of such repair. The aurist can secure this when it would otherwise be doubtful.

Disease of the Drum-head.—Most of the ruptures of the drum-head are due to fluid coming from within. Some of these openings are mere separation aside of the fibers, which close again without scar, while others take place only after so much ulceration and destruction that a large hole is made or the whole membrane may be destroyed. Healing after the loss of tissue causes scar-tissue to form, which is generally recognizable by its thinness and color. It is likely to stretch and sag out of the plane of the rest of the drum-head. Or it may shrink and so distort the drum-head. It was formerly thought that the drum-head was very essential to hearing, and that perforations in it never healed, but caused permanent defect or loss of hearing. On the contrary, however, it may be destroyed by disease or removed by the surgeon with little effect on the hearing, and large openings may close nicely even after having been present for years. The cutting away of the entire drum-membrane is often followed by its complete renewal. Sometimes a membrane not unlike the drum-head forms across the canal outside the real membrane. The protective function of the membrane is very important, and its repair is usually desirable in every case even although it may hinder more than help hearing. Operations have removed it wholly or in part when its condition made it an obstacle to hearing; but these operations have generally failed because of its regrowth, and when successful in securing a permanent opening they have generally been followed in a year or two by a loss of all the power of hearing. Such operations have, therefore, been abandoned. When the drum-head is incomplete the cavity within is likely to become too dry for the best hearing, and it is also constantly liable to the entrance of water or dust, causing severe inflammation. All these inflammations are dangerous, as they can easily extend to adjacent important structures, and fatal meningitis, brain-abscess, or general blood-poisoning may result.

An odd and troublesome condition frequently met when the drum-head is perforated is **grafting of skin-flakes** from the outside of the drum-head upon the moist lining of the middle-ear cavities. Here their extraordinary power of growth is increased by unusual food-supply, and the cavity becomes lined with skin. This is shed rapidly, layer upon layer, and onion-like masses are formed, the so-called **"cholesteatoma."** These may lead to suppuration, cause absorption or destruction of the bony surroundings, opening a way of escape—

outward, perhaps, but too often inward to the brain. Many cases of recurrent ear-discharges are complicated and probably often caused by such collections of shed skin.

The Middle Ear.

The middle ear, tympanum, or ear-drum, lies internal to the drum-head. It is the seat of two-thirds of all ear troubles, and as some of its affections are of the utmost danger to life as well as to hearing, its health is proportionally important. It is much more extensive in size than often considered. The drum-head forms the lower, outer wall of only one portion of the drum-cavity; the **Eustachian tube** extends forward an inch or more and connects it with the naso-pharynx or upper part of the throat, and the mastoid cells or **air-cells,** which extend backward into the mastoid region are also parts of the middle ear. This tube is a part of the upper air-passages; it is very complex, but not easily affected by the diseases of the air-passages, yet as likely to be involved as any of the accessory cavities of the nose. Trouble once set up here is apt to persist. It has been calculated that at least one-third of all our adult population are notably deaf in one or both ears. The census shows that no less than 700 per million **are dumb as the result of deafness.** These are only a small group, however, who lost their hearing before they had fully acquired speech. Most people who are deaf had learned to speak before losing their hearing.

The middle ear is developed from that portion of the air-passages where nose and throat join. At this point is the trumpet-like mouth of the **Eustachian tube.** This opening is situated above the soft palate, but in close relation to the tonsils on each side of the back of the mouth and also close to the more important tonsil in the roof of the pharynx, above the palate. On account of the influence of nose disease on the ear much of the real hygiene of the ear comes in the preceding chapter. The whole middle ear is lined with mucous membrane continuous with that in the nose and throat; as in the latter so its effete cells melt down into slimy mucus instead of being shed as scales. The epithelium has cilia to sweep this fluid on into the throat, and the Eustachian tube is very important as a drainage-canal; but its air-pressure function is equally important. The ear-drum, like the martial instrument, requires a side-opening through which the air-pressure may be kept equal on both sides of the drum-head in order to give it the necessary freedom of movement for its function. If this opening is closed the air will be absorbed by the

moist walls and the lowered pressure will affect the ill-supported drum-membrane and other structures. The greater outside pressure will force in the drum-head, rendering it unduly tense or stretching it out of shape. The stirrup-bone at the end of the chain of ossicles will be pressed too much inward, causing deafness, dizziness, and "noises in the head;" and there will be congestion and oversecretion in consequence of the lessened air-pressure. Normally, every act of swallowing, yawning, etc., opens the Eustachian tubes and gives a chance to equalize pressure within the middle ear and outside, for the palate-muscles, used in yawning and swallowing, act as dilators of the tube; but a stopped-up nose reverses the process and, if the tubes are not stopped, too, every swallowing motion draws air out of the middle-ears.

In the foregoing lie the **causes of most cases of deafness.** It is probable that "hereditary influence" consists really in an inherited form of the nose, or a tendency to catarrhal affections of it. Every "cold-in-the-head" tends in one of the ways above mentioned to involve the ears mechanically, even if the tympanic cavity itself is not involved; and while recovery may seem complete, there is likely to be some remnant of trouble insidiously but steadily increasing, and first one ear and then the other shows decrease in hearing-power. The deafness may be quite marked at first if the ear is much involved, and may be far from totally relieved, although much better as the attack passes off; yet if only one ear is affected the deafness may progress a good deal before the patient notices or even is ready to believe that anything is really wrong. One-third of all adults are deaf to a considerable degree in one or both ears. Examinations in the schools show a less degree of trouble but a very threatening array of beginning cases, with disability of one ear in 10 per cent and of both ears in 5 per cent even of young children.

The question grows much more serious when we consider the inflammatory involvement of the ear which often accompanies the eruptive fevers, especially scarlet fever and measles, but also typhoid and small-pox, and probably in the worst form in diphtheria. In such cases the physician is usually in attendance, and may have to take to vigorous action; yet too often the gravity of the general disease masks the ear-affection and incurable conditions develop that certainly ought to have been foreseen and combated. It may be unfair to ascribe bad results solely to neglect, since even the very best treatment is not always of avail; but it is surely wrong to leave untried the simple measures which may save the hearing, or even the

life, just because it is assumed that the patient is too sick to be thus troubled.

The pus-forming diseases of the tympanic cavities require much more than hygiene, yet hygiene will reduce the probabilities of serious outcome and will make the condition less offensive to friends. Cleansing is the first and sometimes the only thing necessary in abating or curing these conditions, and should be faithfully carried out, under medical direction if possible. A bad odor, sometimes intolerable to those about the patient, is not an infrequent result of incomplete cleanliness; and while full success may be possible after an operation laying open the cavities to secure better access, improvement can generally be secured in the worst cases. Life-insurance companies generally refuse to insure anyone with a discharging ear, knowing that the risk is a very real one, and that serious results may occur at any time. The often-cited prediction that such affections will "be outgrown" if let alone, and the yet falser claim that it is dangerous to check such discharges, have now no competent medical supporters, and the danger of blocking the discharge is utterly different from the policy of lessening or stopping its formation. People are learning that when an otorrhea (ear-discharge) stops spontaneously—as when the rash in measles or scarlatina "strikes in"—it is the **result** and not the **cause** of serious trouble beginning in deeper structures.

General ill-health is a most serious factor in keeping up obstinate ear-troubles, but the latter are, on the other hand, frequent causes of general debility or poor health. Many ear-inflammations of early life are tubercular and may infect the neck-glands first and cause consumption of the lungs or other organs later. Success in securing absorption of such deposits may later prove in reality most disastrous. The ear-symptoms of these attacks are not always well marked, and the case may resemble typhoid fever or meningitis, in the course of which an ear-discharge will be unnoted or ignored. The physician must **search** for ear disease in all doubtful cases without waiting for it to force itself upon the attention, and as soon as he discovers any he must treat it vigorously even if there is little likelihood of a dangerous result. Until this care is always observed there will be many deaths and disablements ascribed to meningitis resulting from the neglect to treat the ear.

Earache.—More within the scope of this work is ear-inflammation arising from "cold," and generally known as "earache." The common assumption that they are mere "neuralgias" is wrong in nearly every case. The affected drum-head is visibly congested, often bulged out

by the secretions within, and pressure in front of the ear almost always reveals tenderness which is pretty sure proof of trouble in the middle ear. Dropping in sweet oil and laudanum will probably be continued in spite of all that shall ever be written or said against it, and roasted onions and hosts of similar substances will be employed to the end of time. "Ear-drops" without number have been vaunted as infallible cures, and the last one used before relief comes gets the credit of curing, although the cure may be in spite of and not because of the use of the "drops." This is all very unscientific and very irrational. Examination alone can determine the form and degree of the trouble. It is sometimes a mere boil of the external canal, due to scratching or accidental infection, with no seriousness beyond the temporary pain and stoppage or perhaps recurrence.

More often the pain is due to catarrh of the middle ear with accumulation of fluid, and will stop only with the escape of the pent-up secretion through the drum-head. Most children have attacks of this sort, and the evidence remains in a minute perforation or in scars so frequently that some anatomists have believed this to be a normal feature of the upper margin of the drum-head. But holes or scars are practically unknown in the drum-head in infancy, are found increasingly frequent throughout childhood, and are present in 25 per cent of all adults, exclusive of the cases in which there was recognized discharge. Hence the scars are not natural but are due to ear-disease. There may have been no discharge or "running at the ear." The small amount of pus forced through the drum-head may not reach the outside or may mix with the fluids dropped into the ear and so escape notice; or the usual sudden relief may be due to opening of the Eustachian tube, allowing exit of the pus through it. The affection may be limited to the drum-head alone, and small blisters or pimples on its surface may cause brief suffering with little deafness or danger. Cold air or cold water may enter the external auditory canal and set up the trouble; but usually it is through the Eustachian tube that these enter, and the condition is direct middle-ear inflammation. Few of the patients who get "water in the ear," especially when knocked about by a breaker, would have been protected by plugging the outside ear. Water in the nose reaching the Eustachian tube has caused the mischief, the choking and coughing or nose-blowing having helped to carry the water into the Eustachian tube, even into the middle-ear. If one blows the nose after spraying or douching he can hear the bubbling in the Eustachian tube-mouth, and the importance of draining away all fluid before blowing is evident.

Carelessness as to this or in using too much pressure with **"the dangerous nasal douche"** has caused ear-specialists to condemn it as well as some other ways of washing out the nose and throat. Watery fluids not in spray should be used only in the narrowest side of a fairly free nose and allowed to escape from the wider side. The pressure should be low, and when the "gravity" douche is used the top of its fluid **should not be above the brow.** All fluids must be as completely drained away as possible before blowing the nose.

In all cases of the diseases with rashes (measles, scarlet fever, etc.) in which the ears are usually in peril, as well as in all cases where earache occurs, **protection** is valuable in warding off evil; and the old-fashioned **night-cap** is excellent for this purpose. A plug of cotton in the ear is as likely to do harm as good, for it is the whole ear-region rather than the ear-canal alone that needs protection in bed. One side of the head is for a while buried in the pillow and perhaps bathed in perspiration, and is then turned up unprotected to the cool air and evaporation, with a probable resulting reduction of forty degrees in temperature in a few minutes. No wonder that an ear that has been threatened with inflammation during the day will suffer acute pain an hour or two after bed-time, as is the usual history of these cases. The night-cap may then give little relief, but will prevent such attacks on subsequent nights. The treatment of such earaches properly belongs to medicine rather than to hygiene, but everyone should know that **heat** is the most valuable single remedy for earache. "Ear-drops" merely serve as a rule to convey heat to the inflamed parts, and pure water can do this better than anything else. It is hard for people to believe that a remedy so universally at hand as hot water is better than the host of less available and less harmless "cures." The **hot-water bottle** to the side of the head. and **gentle douching** or simple pouring of hot water into the upturned ear, generally gives quick relief. Severe inflammations are not cured at once by this or any other means. Free leeching in the early stages, if available, is even better, but hot douching relieves pain by reducing the inflammation, it is safe at all stages and serves to cleanse the canal of such things as wax, skin-flakes, or microbes. It must, of course, be clean and sterile itself. Boiled water, cooled to a bearable heat and used with a syringe that has been well-scalded or simply poured in, will not do the slightest harm. The ear should be dried as well as possible afterwards, and protected by a covering reinforced by cotton or wool as required. Bodily activity or alterations of temperature may greatly aggravate the pain, therefore rest, best in bed,

with light diet is very desirable. Soft food is usually necessary, because every chewing movement gives pain; and constipation or any other cause of congestion of the blood in the head should be relieved if possible. Every case of this kind must be regarded as the initial stage of what may prove serious or even fatal and treated accordingly, no pains being spared to relieve it.

Earache in Children.—A very great deal of the earache of children is due to teeth that are either decayed or are being cut. Babies frequently suffer from earache which is nearly always due to difficult teething. In such cases relief may be given by rubbing the gums with the finger dipped in paregoric, of which a few drops (5 or 6) are put in a spoon to dip the finger into. One tooth—the first of the regular permanent ones—is cut at the age of five or six sometimes (it is usually cut at seven years of age and is hence known as the seven-year molar). The lower teeth are more apt to cause earache than the upper ones. Relief is most easily and surely given by rubbing the gums with a mixture of equal parts of aconite and iodine (that is, the tincture of these). Rub the mixture on the gum over the tooth and about it. Another good remedy is dry table mustard applied to the gum and left till it smarts sharply, when the mouth should be washed out with warm water. Painting or any hot or smarting medicine that is meant for use internally will answer the purpose and is used in the same way as the foregoing. A hot mustard footbath or hot mustard foot-pack is also good in combination with the above.

If the earache is caused by decayed teeth use the treatment given for such.

A dose of physic, or moving the bowels freely, is always good when there is trouble with cutting teeth.

The Internal or Inner Ear.

Sometimes in middle-ear disease the internal ear also becomes involved. This may be by direct extension of the inflammation, with rapid destruction, or it may follow upon disorder of the conducting apparatus and resulting atrophy through disuse of the percipient apparatus situated in the inner ear. In certain constitutional diseases an overwhelming dose of the poison generated in the course of the disease may set upon the nerves of hearing without any other symptoms of ear-involvement. Mumps, less often diphtheria, but most often inherited or acquired syphilis, may produce even total deafness. Meningitis would doubtless leave deafness in many cases but is so

very fatal that these are seldom met. Tonic medicine and measures to promote the absorption of inflammatory products may save the hearing more or less; and in every case in which it is probable from the mere absence of local disease, that the auditory nerves are the seat of the deafness, such treatment should be given full trial.

"Noises in the Ear" (Tinnitus Aurium).—"Noises in the head" which often accompany deafness are often quite as annoying as the deafness itself. These are various in character—roaring, hissing, ringing, screaming, friction-sounds, thumping—and many of them seem unbearable, especially if always present. The noises are not

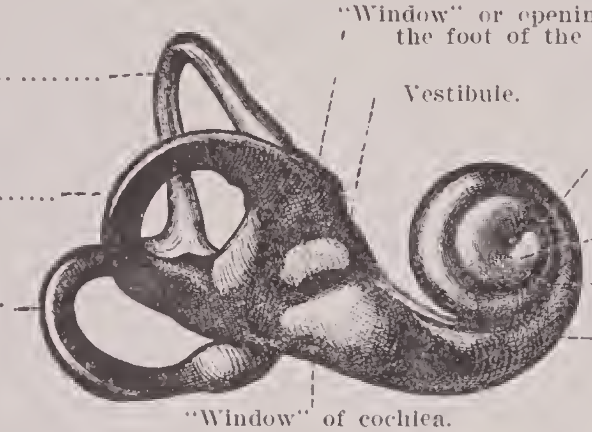


Fig. 136. The internal ear. A cast or mould of the canals and spaces in the bones, in which the nerves end, enlarged 3 times. The snail-shell (cochlea) is the organ of hearing. The vestibule (and semi-circular canals) is the organ of equilibrium (tells us our position and movements when our eyes are shut and so helps to keep our balance).

definitely related to defect of hearing, and may persist for years without deafness or may be wholly absent while the hearing is distinctly failing. However, they are often enough associated with deafness to make them dreaded as a forerunner and addition to that calamity. They sometimes defy all efforts to stop them and may even keep the patient awake and have probably been a real cause of suicide. Their origin is as varied as their character. They are generally due to pressure upon the nerve-endings in the labyrinth of the internal ears. Alterations in the quality or pressure of the blood are often the cause, and anemia or plethora may be the cause. Disease of the middle ear or Eustachian tube is responsible for many cases. Others are due to irritation within the skull, perhaps without the least ear-trouble. In a few cases the real seat of the trouble is in the nose, and minute examination will show one or more areas of firm contact of parts which ought to be well separated. Proper treatment—shrinking, moving, or removing the tissues concerned—will give prompt and perhaps permanent relief. In certain other cases the

general condition of the circulatory system, and especially overaction of the heart, is the main cause of the trouble and must be medically treated. In rare instances there is a local dilatation of an artery (an aneurysm) giving rise to an **objective noise** (which physician as well as patient can hear), and which pressure on the artery lower down will stop. Another form of noise which can be heard by others is a clicking due to opening of the Eustachian tube when the soft palate is lifted. It may be very distressing when there is spasmodic action of this sort and active tonic measures are urgently required.

Tests for Hearing.—The tests of hearing and the recognition, estimation, and localization of its defects are very important. Much of the matter is outside of the field of hygiene, but certain broad facts deserve better general recognition. The ears should recognize sounds ranging through about ten octaves; so, to be thorough, testing must have very wide scope. The watch, which is often used as a test, has an impure, high sound of little practical value, since it may be well heard by very deaf ears or poorly heard by those perfect for all other tones. The voice is far more practical, since it has a wide range of pitch—perhaps from 100 vibrations per second to 5,000 per second. It can also be greatly varied in volume. A faint whisper should be audible for ½ meter (20 inches) in a quiet place, and only by the ear directed toward the speaker; a "stage" whisper, with the air remaining in the lungs after an ordinary expiration should be heard 15 meters (49 feet); while the need of a loud voice to be heard marks extreme deafness. Tuning-forks of various pitch are good for quantitative testing and enable us to compare the hearing through air with that through the bones of the head, and thus to locate the seat of the trouble. In affections of the **outer or middle ear** hearing for low tones is likely to be impaired or lost first, while it is higher tones that usually suffer in **nerve-deafness.** A tuning fork may be heard unduly loud and long when resting by its handle on the head, but be ill-heard in the air when held before an ear with impaired conducting-apparatus; but with nerve-deafness sound is not heard so well when conducted through the bones of the head as when conducted in the ordinary way through the air and the middle-ear—the bone-conduction suffers more than the conduction through air. Hence a vibrating tuning-fork placed on the head in the middle line ought to be heard louder in the deafer ear **if the trouble is in the middle or the external ear**; but worse in the deafer ear **if the nerve-apparatus is at fault.** When placed on the bridge of the nose, the ears should hear the vibrating fork as long as the fingers holding its handle feel the vibra-

tions; the duration of the sound thus heard is measurably less **when the nerves are affected,** and greater **in impairment of the conducting parts,** as this shuts in the sound, just as it shuts out air-vibrations. Thus by a series of tests it is usually possible to decide the amount and location of the defect of hearing, and proper measures for its relief may then be taken. It need hardly be pointed out that cases of deafness due to a plug of wax closing the canal, or to fluid in the middle ear, or to a forcing in of the drum-head by lowered pressure in the middle-ear will not all be relieved by the same measures. Nor would the appropriate treatment for those be of any avail in cases of paralysis of the auditory nerve by the poison of syphilis or by the pressure of a blood-clot or tumor. In other words, the cause and seat of the deafness must first be found before treatment can be intelligently, successfully or hopefully applied.

Ear-Trumpets.—These are offered in many forms and with shameless claims of impossible virtues. Some of them have good points **for the few cases for which they are suited:** none have half the value or field of usefulness claimed by their vendors. "Ear-drums" have already been discussed. Ear-trumpets are valuable usually in direct proportion to their size, since they aid solely by collecting and concentrating a greater volume of sound-waves into the ear, and small aids are usually of little value. When the hearing through the bones of the head is much better than through the air, fan-like instruments held to the teeth may prove real helps. Out of a dozen of the same make one or two trumpets may be far better than the rest, and the deaf person should consult a competent doctor as to the kind of instrument to test and then try a number of that form, choosing finally the one that trial shows to be the best for him. Such aids are not only of temporary convenience, but when rightly used they may permanently better the hearing.

How to Maintain Healthful Conditions About the Home

Important Matters in Home Life, Affecting General Health.

The Location and Construction of Home. Ventilation, Heating, Lighting, Pure Water Supply, Plumbing, Drainage, Garbage and Ashes.

Subject Reference

For Warning as to Water Supply, see Vol. 2, pages 502 to 506.

For advice regarding Temperature and Moisture of Air, see Vol. 2, pages 507-508.

Location.—The first consideration in selecting a site for a habitation of any sort is the **nature of the soil.** Dampness and organic impurity are the principal things which render a soil unhealthful. The house should therefore stand upon a site the subsoil of which is either naturally dry or properly drained and which is free from organic impurity. The **contour** of the surface, the **elevation**, and the **exposure** (i. e., the direction in which the ground slopes) are all to be carefully examined and considered. The **source**, **nature**, and **amount** of the available water-supply should be suitable. The economic and safe disposal of all refuse matter must also be had in mind.

The **elevation** of the site should be sufficient to secure good drainage, if possible on all sides, away from the house. A **southern exposure** is preferable, except in hot countries. An **abundant supply of fresh air and sunlight** is essential and the house should be so far from others that these can be secured. Absence of sunlight and too scant a supply of fresh air are the most important predisposing causes of disease in the homes of the poorer classes in large cities. The windows should be protected with blinds and if necessary also with awnings in summer, to exclude the excessive heat and too glaring effect of the sun; but in winter so far as possible the full and free sunlight, because of its purifying influence, should be allowed to enter every room, at least during a part of each day.

Foundation and Walls.—The structure of the walls, the materials of which they are made, and the number of layers of these materials employed all go to determine the healthfulness of the house. There is no great hygienic difference in wood, stone, or brick, if the walls and foundation of the house are so constructed as to exclude dampness. This can be done by means of **double walls**—that is, by an air-space within the wall. The foundations and walls should be kept as

dry as possible. In damp soils this can be secured only by thorough draining of the subsoil below the foundations, and by cementing the foundation-walls and cellar-floor.

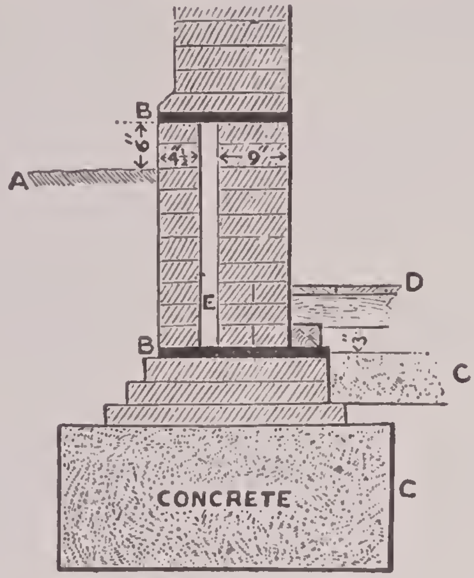


Fig. 137. A *dry* foundation. *A*, ground level. *B*, *B*, damp-proof courses. *C*, *C*, concrete. *D*, floor. *E*, hollow in the wall.

The roof of the house must be carefully and properly constructed so as to prevent leaking. The material of which the roof is made is of little hygienic significance so long as it excludes rain. An air-space between the roof and the ceiling of the upper rooms protects against heat in summer and cold in winter. The rain-water from the roof should be carried away from the house through proper drains, or into a cement cistern, so as to prevent the soil about the house becoming unduly damp.

The internal structure of the house is as important as the site, materials, and mode of construction. The height and number of stories, the size and arrangement of the rooms, and the disposition of doors and windows are to be considered, as all have an important bearing upon the health of the occupants.

The minimum **height** of the rooms is nine feet, while the maximum height is about thirteen feet. The floors and ceilings must be allowed for in addition. The **amount of cubic space** which should be supplied for each person in a room is about 1,000 cubic feet. Thus a room 9x12x9 feet would contain the amount of cubic space required for an adult. When the height of a room is less than nine or more than fourteen feet ventilation is more difficult. In a room less than nine feet high the other dimensions must be increased to give over 1,000 feet of air per individual in order readily to supply enough **fresh** air; the ventilation and heating become less easy, because it is harder to cause regular movements of air in a horizontal than in a perpendicular direction. Again, in rooms over fourteen feet in height,

the air stagnates in the upper part of the room and the regular and complete displacement of the stale air by fresh air is prevented.

In examining the air of your room do not mistake **coolness** for **freshness.** The **smell** of the room is the best ready test of its cleanness and proper ventilation. Even a dirty room well aired does not smell as disagreeable as a clean close room. Of course, one must come in from the fresh outside air in order to be able to test the air of a house by smell.

The **arrangement** of the rooms should be such as to minimize the distances and energy used between the parts most used; consequently **stairways** should be avoided as much as possible. Unless the **price** of land is too great, the house should not be more than two stories in height. This does not include the cellar or basement, nor the attic, which may be little used for living purposes. This will necessitate having the building over a larger area of ground. The architectural effect can usually be made as pleasing in a two-story house as in one of three or four stories. The ventilation and heating of a house two stories in height are somewhat more difficult than in one having the same number of rooms but which is three or four stories high, because it is harder to distribute currents of air in a horizontal direction. This difficulty does not, however, outweigh the great advantages of the lower house afforded in other directions.

The cellar should be well lighted, properly ventilated, and kept clean, no refuse matter being allowed to accumulate in it. If it is used as the dumping-place for refuse materials, the air in it becomes tainted, and finding its way into the living rooms, vitiates the air of the entire house.

The kitchen should be large, well lighted and properly ventilated, because the most important work of the household is done in it. Scrupulous cleanliness must be the strict rule in the kitchen. The **sinks** should be carefully cleaned every day, to avoid the accumulation of grease and refuse matter, from which foul odors and gases may arise. The **refrigerator** must be kept scrupulously clean, or odors will develop and taint the food contained in it and make it unfit for use.

Stairways should not be too steep but have an easy slope. The **steps** should be broad and low, to minimize the exertion of going from one floor to another. The **hallways** should be well lighted, so no dust may be allowed to remain unnoticed and undisturbed in dark corners. All **draperies and curtains** should be very limited, because they catch dust and keep out sunlight and prevent free circulation of

air. The curtains should be of such materials as permit of frequent laundering. Plush or velvet-covered **furniture** is objectionable, because it catches dirt and dust and does not admit of satisfactory cleaning. Where such furniture is in use, it is well to have linen covers which can be frequently washed or taken out, shaken and aired.

Doors and windows should be so placed as to admit all possible fresh air and sunlight, the two greatest health-giving agencies in nature. If possible, doors and windows should be on opposite sides of the room, in order to have cross-ventilation.

Walls and wall-coverings have a hygienic influence which is commonly neglected. It is usually the custom to cover the walls and often the ceiling with wallpaper, and when it becomes soiled, another layer is placed over it. This is often continued until many layers are fastened on the walls, each with its accumulated dirt. This practice of repapering without previous removal of the old, soiled paper cannot be too strongly condemned. The filth accumulated through months and years of constant occupation is merely covered over. The paper is porous and is especially apt to retain the germs of disease in the house if efficient disinfection is not practised, and to cause serious chronic ill-health or even acute illnesses of the occupants.

When repapering is necessary, all the soiled paper should be thoroughly removed and the walls scrubbed with some good antiseptic solution, such as chlorid of lime, before a new coat of paper is applied. This is especially necessary after sickness, particularly consumption. The use of wall-papers is not good from a hygienic standpoint. It is far preferable to have the walls painted, alabastined or calsomined. Paint may be scrubbed and cleaned without injury. Soiled calsomined or alabastined walls can receive a fresh coating.

The robust health of our ancestors is to be attributed, at least in part, to the fact that wall-papers were not formerly in general use. Usually the interior of dwellings received frequent and liberal coatings of whitewash, and were thus made almost perfectly clean, as freshly slaked lime is one of the best disinfectants.

Floors and floor-coverings in most houses are chiefly receptacles for filth carried on the shoes from the streets. The dirt is rubbed off on carpets and rugs and settles into them, to be in part later distributed into the air of the rooms by "dusting" and sweeping. This is a direct danger to the health of the occupants. The floors beneath the carpets often afford additional receptacles for the dust which penetrates the floor-coverings. The slightest disturbance of the floor-

coverings by sweeping, or even by walking across them, will raise clouds of dust laden with the germs of disease. Ordinarily the readiness with which dust is raised is not recognized. If a room be darkened and then a beam of sunlight be admitted the dust floating in the air becomes visible as "motes in the sunbeam," and great clouds are seen to be raised by merely walking across even a bare floor, and, of course, from a carpet larger amounts are as easily raised—and every particle may be covered with disease germs, and indeed many of the particles are germs. This is a fruitful mode of spreading disease.

Floors should be hard, impervious to moisture and free from cracks and crevices. Wooden floors can be made thus only by means of oil and paint. All the cracks must be filled. The economy practised in rural districts of **painting the floors** instead of covering them with carpets lessens the danger of the occurrence of disease. To some extent, the same conditions are found in some of the better class of modern dwellings. Very pleasing effects are obtained by means of **inlaid floors** of different colored woods. These may be put down in any house on soft wood or other floors.

The use of carpets and Japanese matting is not required on painted floors. Instead of carpets and matting, a few **rugs** may be used. These meet all hygienic requirements; they are not fastened to the floors as carpets are, consequently they can frequently be removed bodily, well shaken, aired and sunned, and the floor thoroughly cleaned. **Carpets,** on the other hand, are usually allowed to remain on the floor for months and even years, resulting in an astonishing accumulation of dust in them and underneath, even with the greatest degree of cleanliness possible under such conditions—as witness a carpet-beating even for the best housekeeper!

In **sweeping,** the floor should be liberally sprinkled with newspaper that has been soaked and then torn into shreds, or washed tea-leaves may be used. This is easily done and it not only makes it easier to sweep **clean,** but it prevents raising a dust and so does away largely with the need of "dusting." Such dust as gathers on the furniture, shelves, window-sills, etc., should be wiped up with a soft, **damp** cloth. A little turpentine in the water used to dampen the duster has a freshening and disinfecting effect.

Ventilation.

The need of keeping the air of our homes pure is generally recognized. During the winter months it is not possible to keep the indoor

air as pure as the outside air, since there is a certain amount of accumulation of the impurities due to respiration, perspiration, and combustion. It should be endeavored, however, to keep this accumulation as low as possible. This is done by **dilution**—that is, by bringing in a constant supply of fresh outside air to **displace** a part of the indoor air and to **mix** with the remainder. This is known as **ventilation.** The impurities of air due to respiration, perspiration, and combustion which make ventilation necessary are, principally, carbon dioxid, water-vapor, minute quantities of organic or animal matter, and dust. While the amount of these substances usually present in the air of ordinary dwellings is not great enough to be poisonous, they are, nevertheless, injurious if present in relatively large amounts for long periods of time. They are depressing or irritating to the nervous system, and through it affect all the functions and well-being of the whole body. They also lessen the proportion of **oxygen,** the life-giving agent of the air.

The proportion of carbon dioxid (also called "carbonic acid gas") in the air is an indication of its purity or impurity. The carbon dioxid is in itself not injurious in the amounts usually present in air, but is

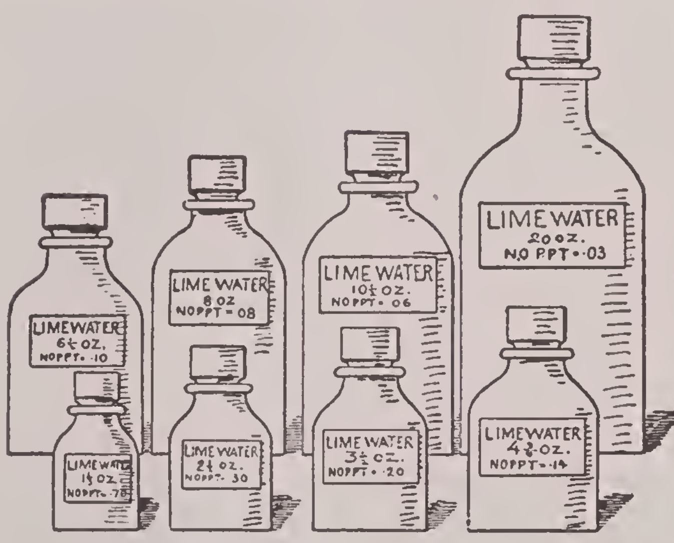


Fig. 138. To test the air for carbon dioxide (carbonic acid gas). The capacity of each bottle is marked on it. Each bottle is first filled with warm boiled or distilled water. It is emptied in the room to be tested, and thus filled with the air of the room. One-half ounce of lime water is then put in each bottle and the smallest one in which any milkiness appears is noted. The decimal number on the next smaller bottle then tells the percentage of CO_2. Thus: No ppt-=.30, means "No precipitate indicates .30% carbon dioxide" (or not over this much).

readily estimated and has been found to be a fair indicator of the relative purity of the air. The amount of carbon dioxid in air may be estimated in a variety of ways, but all the methods depend upon the same principle—the amount of precipitate produced in a definite quantity of lime-water by a known volume of air. When carbon dioxid is shaken up with lime-water it combines with the lime to form chalk which is **insoluble,** and therefore a **precipitate** results and makes the clear lime-water milky, or turbid. A simple **household method** for roughly estimating the proportion of carbon dioxid in air consists in

washing measured quantities of the air with ½ ounce of lime-water in bottles of different sizes (Fig. 138). The bottles are filled with the air to be tested and then ½ ounce of lime-water is poured into each and the bottles are shaken. The one in the series which just shows visible milkiness gives the percentage of carbon dioxid present in the air tested. Thus, if the 8-oz. bottle shows a slight precipitate while the 6-oz. shows none, then the air contains less than 1-10 per cent and more than 8-100 per cent of carbon dioxid.

Outside air constantly contains from 0.03 to 0.05 per cent carbon dioxid. So long as the air of our houses contains not more than 0.05 to 0.07 per cent—that is, 0.02 per cent in excess of the outside air, owing to respiration—the ventilation is satisfactory.

The purity of the air of a room can be determined approximately by the sense of smell. The first impression obtained on entering such a room from the outside air is the best test of the purity of its air. **The odor of organic matter** given off from the lungs and bodies of the occupants in a crowded room is very offensive, and the relative amount present is readily detected. Pure air is **fresh and sweet,** while organic impurities render the air **close, very close,** or **fetid,** according to the amount present.

In overcrowded rooms there is always too much **humidity** in the air. The moisture in the air when excessive is a source of discomfort, probably because it diminishes the normal evaporation of moisture from the surface of the body, and consequently causes the retention of impurities in the body that should be regularly eliminated. Excessive humidity of the air may thus also prove injurious to health. The most healthful amount of moisture in the air is **about 75 per cent of saturation.**

Ventilation is intimately connected with the problem of heating, since the outside air admitted is cold and displaces a corresponding amount of warm air. It is a simple matter to bring in fresh air, but when the outside temperature is near the freezing-point, it is impossible to ventilate by merely opening the doors and windows. The outside air must be brought in in such a way as to avoid drafts, since cold air striking any portion of the body may be detrimental to health. Therefore, the fresh air is best got in a number of small continuous streams, to prevent the sudden cooling of the contained air, as well as to avoid drafts. The objection to a draft may also be overcome by bringing in the air at such a height that it cannot strike directly on the occupants of the room, and it may also be warmed to a temperature approximating that of the air of the room itself.

Ventilation may be brought about either by **natural** means, by movements due to heated columns of air in ventilating flues, or by **artificial** means, as with fans or blowers. The frequency with which the air of a room should be changed depends upon its size and the number of the occupants. A space of 1,000 cubic feet for each individual requires a complete change of the air three times in each hour, in order to dilute the impurities due to respiration and to maintain the air at the required standard.

Fig. 136. A convenient and safe way to ventilate. The arrows show the fresh air entering between the sashes, while the space below is closed by the board fitted into it beneath the lower sash.

Many devices have been suggested for bringing in fresh outside air in **natural ventilation**. The simplest of these is by the insertion of a board, 3 or 4 inches wide or even wider, under the lower sash of a window. This allows the entrance of fresh air between the lower and the upper sash, and gives the incoming air an upward direction. The cold air rises toward the ceiling, is distributed in all directions and then gradually sinks to the floor.

In **artificial ventilation** the fresh air is either propelled through the house by means of a blower (a method known as **perflation**), or the contained air is abstracted (known as **aspiration**) by the same means, the fresh air in this instance gaining entrance usually through cracks in doors and windows, through porous walls and floors, or through special inlets. The results obtained by these methods—propulsion or abstraction—are equally satisfactory. The propulsion method is preferable, however, because the incoming air may be passed through

or over steam coils to warm it, and the place of intake may also be selected so as to get the purest air available.

Heating.

Heating may be effected by means of stoves, open fireplaces, hot-air furnaces, petroleum heaters, gas radiators, and steam or hot-water radiators. Electricity is also used, but not generally, being as yet confined chiefly to electric-propelled cars.

When the heater is placed in the room to be heated, **direct radiation** is the method; when it is placed in some other part of the house from which the heat is transmitted, the heating is by **indirect radiation.** Stoves cause a great deal of annoyance, because of the greater work in caring for them, the dust produced, and the unequal distribution of the heat. The same objections apply to open fireplaces, which also give rise to unpleasant drafts and are very wasteful, as most of the heat goes up the chimney. Petroleum and gas utilize large quantities of oxygen and thus rapidly impoverish the air of the rooms heated in this manner.

Ventilation is intimately connected with heating, as it is impossible to bring in fresh outside air without displacing an equal amount of the warm inside air. It is therefore more economical and satisfactory to ventilate by means of previously warmed air, thus combining ventilation and heating. This **combined system** of ventilation and heating is used in ordinary **furnace-heating**, in which the only heat is that carried by the fresh air which has passed through the furnace and become heated. The most satisfactory other system of combined ventilation and heating is by **steam radiators placed in stacks,** through and over which the fresh outside air passes on its way to the different parts of the house. This combined system of ventilation and heating is now in very general use, both for private dwellings and also for office-buildings, hospitals, hotels, schools, churches, etc. By adjusting the size of the flues and the speed of the blower, a fairly definite amount of warm air may be supplied to each room as required by its relative size and location. In ordinary dwelling-houses it is usually unnecessary to have a blower to propel the heated air; being heated as it passes over the steam-coils it expands, and thus becoming lighter it is displaced and pushed upward by the cold air behind it, which being heated is in turn displaced. This is usually sufficient to carry the warm air to all parts of the house.

In such a combined system of ventilation and heating exits must be provided in each room for the escape of an equal volume of the

contained air, since the fresh heated air can be brought into a room only as fast as the contained air is leaving it. Oversight of this frequently causes dissatisfaction with this method of ventilation and heating.

In the **heating of dwellings** two things are to be carefully guarded against from the standpoint of hygiene, viz., **excessive heat** and **undue dryness of the air.** The production and distribution of dust and gases resulting from combustion also sometimes are so great as to affect the health injuriously. Excessive heat, undue dryness of the air, and much dust occur most frequently in furnace-heated houses. Too great heat may be avoided by proper control and regulation of the fire, and by using the windows as outlets for hot air, by opening them as described for simple ventilation. Too much drying of the air is less easily controlled. In winter the relative humidity[1] of the outside air is generally not very low, but when it has passed through the furnace and become heated, its relative humidity is excessively low, not because it loses any moisture but simply on account of the increase in temperature, which gives the air a greater capacity for holding moisture.

In spring, when the outside air is warmer than the air in the house—or than the **walls** of the house inside—care must be taken not to make the house damp while endeavoring to warm it by admitting outside air. The latter is usually moisture-laden in spring and any cooling causes it to give up some of its moisture, which will deposit on the walls. Similarly, cellar windows should be opened **only when the outside air is cooler than the cellar walls or floor.**

The dryness of the air may be overcome, at least in part, by keeping the water-reservoirs of the furnace well supplied with water. This gives opportunity for the air to take up more moisture on its way from the outside to the rooms to be heated. Several other ways have been devised for increasing the humidity, such as placing a wet sponge or a small pan filled with water before the inlet-opening of each room.

This is a most important matter, both hygienically and economically. Careful tests have shown that a room at 68° F., with a relative humidity of 60, is **more comfortable** than at 72° F. with a relative humidity of 30. Not only does it take less coal to keep a room at 68° F. than at 72° F., but the occupants of the house at the lower

[1] *Absolute humidity* is the total amount of vapor, or moisture, contained in a given volume of air; *relative humidity* is the proportion of the amount present relative to the amount necessary to saturate the given volume of air.

temperature are much less subject to diseases of the respiratory system, such as common colds, bronchitis, pneumonia, etc. Possibly the drier air at 72° F. causes a much greater evaporation from the surface of the body than the moister air at 68° F., and hence one does not feel any warmer. To sum up in regard to heating: Living rooms should be heated as nearly uniformly in all parts as possible, either by heated fresh air or by heaters over which the fresh air passes in entering; the temperature at which the room is best kept depends on the occupation of the persons in it; ordinarily 68° F. is warm enough if the air is not too dry. Feeble persons require more warmth.

The production and **distribution of dust** are readily controlled by the person attending to the furnace-fire. If the dust-flues are opened before shaking or dumping the fire, most of the dust passes up the chimney instead of finding its way into the rooms of the house through the hot-air shafts. The hot-air shafts should be taken apart and cleaned every fall before the furnace-fire is started, in order to remove the dust accumulated in them during the summer, otherwise this dust finds its way into the living rooms in the first weeks during which the furnace is used, and may prove decidedly detrimental to the health of the occupants. This dust, because of its irritating effect upon the respiratory tract, is, at least in part, the cause of the colds contracted at this season of the year.

Cooling the Air of Houses.—During the summer months it is often desirable to cool the air. Small electric fans are commonly used to propel the air quickly through a room, thus cooling the body by the greater evaporation from the skin and because of the rapid renewal of the air in contact with the body. This is really not cooling the air, but cooling the body. The air of the whole house may be cooled by passing it through a chamber filled with ice (a very expensive method), or through a screen over which a spray of cold water is falling. Liquid air has been tried recently for cooling the air in summer, and proves satisfactory in the ventilation of theaters.

For practical purposes it usually answers for keeping the house cool, to open the windows well at night, closing them and the blinds and shutters early in the cool of the morning. Trees and vines to shade the windows are also helpful. But one should not neglect such measures as light clothing, low shoes, morning sponge or cold bath, light diet, and, above all other hot weather needs, have absorbing employment that leaves you no time for finding fault with the weather. Take eight hours sleep at night, rise early to do your work,

take a nap in the early afternoon, and drink plenty of cold water in small quantities, and, if necessary, wet your hair occasionally during the heat of the day. Vigor of body is the best means of keeping cool.

Lighting.

The subject of lighting is discussed in detail in the chapter on the Eye.

Water-Supply.

The purity of the water-supply is as important as the purity of the air-supply. The principal water-carried diseases are typhoid fever, cholera, diarrhea, and dysentery. The specific causes of typhoid

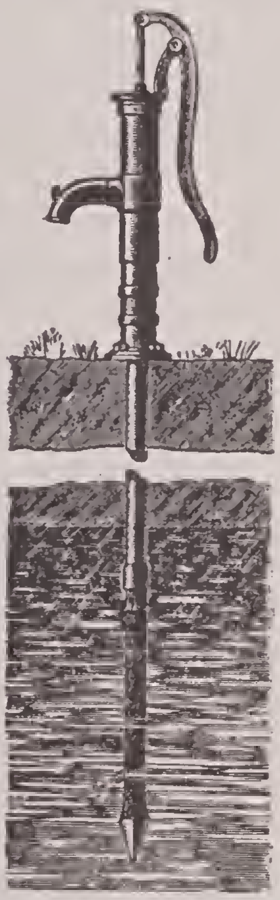


Fig. 139. A drive well. This can be quickly put down a long way. There is no "well" and hence no chance of mice or other objects falling in and spoiling the water.

fever, cholera, and dysentery are well-known species of bacteria. These bacteria get into the system by way of the mouth, usually in infected water or infected food. In the course of the disease the bacteria causing these diseases are given off from the body of the patient by way of the bowel or kidneys—that is, in the feces or urine. Out of the body the bacteria probably still can multiply and

spread, but only under certain conditions. They likely soon lose the power of growth and become less virulent and may die. Therefore we usually contract typhoid fever, cholera, or dysentery by taking into our stomachs food or drink which is infected with something that had previously passed through the intestinal tract of some other person. How important it is then to have a water-supply that is free from any such contamination! As is elsewhere described more in detail how food is infected with the germs of these diseases, it need only be mentioned here that flies and the hands of attendants are the principal carriers of the germs to the food. Infected water also used to wash either the person, or food, or dishes for table use, or milk-containers, may make any of these the direct source of the germs of the disease.

Municipal Water-supplies.—In thickly populated districts every individual has the right to expect, and demand, of the municipal

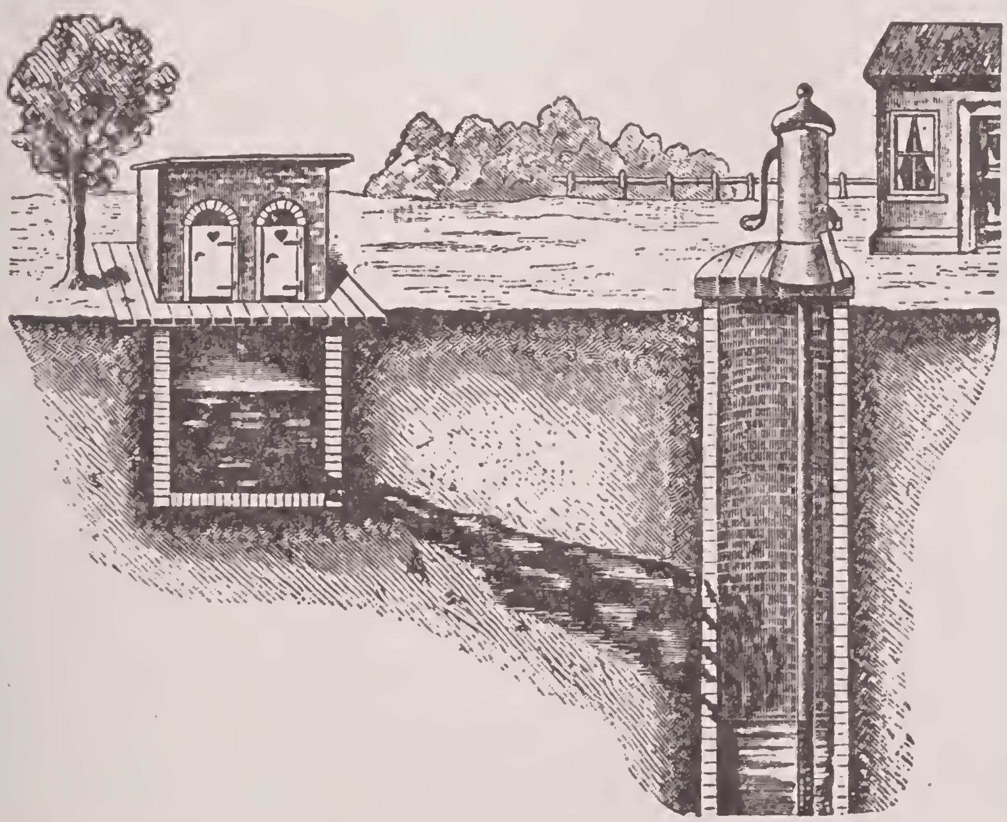


Fig. 140. Contamination of a well by drainage from a closet. This may occur at a very considerable distance in gravelly or sandy soil, especially if there is not proper drainage and if the closet has no concrete lining for the receptacle in the ground.

authorities certain safeguards against the causes of ill-health. In such communities the responsibility for the **purity of the water-supply** is transferred from the individual to the municipal authorities. The individual, therefore, has a right to demand a municipal water-

supply that is sufficient in quantity for all ordinary domestic uses and **reasonably** free from substances injurious to health.

If natural water in sufficient amount and purity cannot be obtained, the municipal authorities must **purify the water** that is least polluted and most readily obtained. The question of municipal water-supply has received a great deal of attention in recent years from men whose business it is to study for those conditions upon which the healthfulness of a locality depend—so-called **sanitarians.** Purification plants have been installed in a number of municipalities. The method of purification must be suited to the character of the water of the locality; for instance, the waters of the Ohio and Potomac Rivers are of such a character as to be more satisfactorily purified by the method of **rapid filtration through sand,** with the addition of **alum,** which coagulates substances in the water (which may be harmless in themselves) and so restrains the fine particles of clay found in these waters from passing on in the filtering water. The waters of most rivers of the Southern States are like these. The rivers of the Middle and New England States generally contain smaller amounts of clay suspended in them (are clearer), and for the purification of these waters the **slow** sand-filters, without the use of alum, have been found most satisfactory.

Domestic Filtration.—In those municipalities whose water-supply is not free from danger to health, and where the lack of finances has as yet prevented the installation of a satisfactory system of purification, the individual householder is obliged to purify the water for his own use. In many cities and towns where the water-supply has been notoriously bad for a number of years, individual householders have tried various means for overcoming the evil. Many hospitals, hotels, apartment-houses, schools, and private dwellings are equipped with **individual filters** which are like the rapid sand-filters, using alum as a coagulant. These filters purify all the water entering the building, and if properly constructed and intelligently cared for, prove efficient. Many people purify the water for cooking and drinking by filters composed of cylinders of **unglazed porcelain, baked infusorial earth,** or **sandstone.** These filters act merely as strainers, their fine pores preventing the passage of bacteria. The serviceability of such filters is, however, of short duration, for usually in a few days the bacteria in the water grow through the pores of the filter (perhaps by means of their minute **spores** or seeds) and so get into the filtered water. If the filters are not boiled or baked frequently, the filtered water will in time **contain more bacteria than the applied water,** i. e., the water

before filtering. Filters of this class must, therefore, be scrubbed and boiled for half an hour once or twice a week in order to maintain their efficiency.

Other measures for the purification of drinking-water in the household which are of greater value and usually greater cost are **distillation** and **boiling.** Special forms of apparatus for distilling drinking-water have been devised. These yield a pure and satisfactory water. It should be aerated to remove its flatness of taste. This may be done by shaking it up with air **after** cooling, or by adding to it a small quantity of soda-water (i. e., water surcharged with carbon dioxide).

Plumbing and Drainage.

House-Drains.—Where a general water-supply is established, it is necessary also to provide means for the removal of the waste-water. In most modern towns a system of **underground drains** (or sewers) is used to carry the household wastes away from the town limits. The household waste of each house is carried through a 4- to 6-inch iron pipe, known as the **house-drain** or **soil-pipe,** into the sewer under the pavement of an adjoining street. All the waste-water from kitchen-sinks, laundry, bath-tubs, water-closets, and wash-basins is carried out in the soil-pipe.

All bath-tubs, sinks, water-closets, etc., are connected with the house-drain by pipes which retain a small amount of water in a bend of the pipe, which seals the connection and thus prevents gases from passing from the house-drain into the rooms of the house. Such a device in the pipes is called a "**trap.**"

In modern houses the house-drain is made of heavy wrought- or cast-iron pipe of the same diameter in its whole length. It has a trap between the house and the sewer to prevent air from the sewer passing through the house-drain into the house. It also has a "ventilator" opening between the house and the trap, so that any gas in this part of the pipe may escape instead of being forced back into the house. The house-drain extends for several feet above the roof of the house, and its upper end is left open to allow a free circulation of air throughout its entire length. When thus constructed, and all sink and water-closet connections are properly trapped, the escape into the house of any air contained in the house-drain or the street-sewer is impossible.

All the pipes entering the house-drain should do so **at an acute angle** and **be tight,** to prevent leakage. This is very important. The

danger from leaky joints is not so much the escape of gases, as the leakage of liquids, which accumulate on the premises and cause decomposition and bad odors. In modern dwellings, if the plumbing has been properly done, there is very little danger from so-called **"sewer-gas."** In modern sewers and house-drains the air is not much more impure than the air of the overlying streets.

If there is no general sewerage system the house-drain should lead into a **cesspool.** Cesspools should be located at such a point and constructed in such a manner as to avoid contaminating neighboring wells or streams.

Bath-rooms and toilet-rooms have been introduced into houses wherever adequate water-supplies and the construction of sewerage-systems have made this generally possible, with a consequent very beneficial influence upon the health of the inhabitants of modern towns. It has made a much greater degree of personal cleanliness possible, and has brought about a marked reduction in those diseases which are spread by sewage-polluted water.

Toilet-rooms should be supplied with **closet-seats** of the **wash-out** or **wash-down** type, of which the former is the most satisfactory. The closet-seat should be furnished with a small flushing-tank of from two to three gallons capacity. Such tanks are known as **"water-waste preventers."** They efficiently flush the closet each time it is used, and thus serve to prevent the use of excessive amounts of water that would be used by a continuous flow.

The bath-room floor and side walls should be covered with porcelain tiling, if the cost does not prohibit. The bath-tub should be **porcelain-lined cast iron.** This is durable and readily kept clean. Neatness and cleanness of bath-room fixtures invites frequency of their use.

Garbage and Ashes.

The health of the household demands the prompt removal of all materials which may be a source of nuisance in the form of disagreeable odors or of irritating dust. Consequently the systematic removal of garbage and ashes must be provided for.

Garbage, or kitchen refuse, may be disposed of by **burning in the kitchen-range** if the family is small. In larger households other means of disposal is usually necessary. **Special furnaces** have been devised for the consumption of garbage. In most cities and towns regular **scavengers,** whose duty it is to collect the garbage at regular intervals, are provided by the town corporation. The collections

should be made at least once daily during the summer months, and two or three times a week during the remainder of the year. Complaints should be made to the proper officials if the collectors are careless or irregular in their work. In rural districts the garbage is usually put to a profitable use in feeding cows, pigs, or poultry.

The Disposal of Ashes.—Ashes should not be let accumulate on the premises, but for hygienic reasons should be removed at short intervals—once or twice a week—and in such a manner as to avoid dust or litter. Separate collectors for waste-paper and other refuse of like nature should be provided, while the ashes are kept by themselves. They must be dampened for handling, to avoid dust.

Nuisances.

By nuisances is meant such disturbances as foul odors, noxious fumes, loud noises, dust, smoke, and soot. Nuisances may not be directly injurious to health, but they are indirectly injurious by causing discomfort and annoyance. Usually, they are due to causes outside the home, and are, therefore, beyond individual control, as in the case of noxious fumes arising from certain manufacturing industries, loud noises of cities, due to traffic over rough pavements; the shriek of factory and locomotive whistles, the tolling of bells, railway noises, and dust and smoke, etc. One of the most disagreeable neighbors in a town is a gasoline engine.

Foul odors within the house are due to neglect of proper care and cleanliness of cellars, sinks, drains, and water-closets. The use of deodorants for removal chiefly substitutes one odor for another, masking the odor without really removing it. Strict cleanliness is the only proper remedy.

Industries in which the generation of noxious fumes cannot be avoided should never be located in the residential part of a town, but preferably in the outskirts of the town.

City noises are of such a nature in general that many of them, as the prolonged or very frequent blowing of steam whistles and the tolling of bells, could be avoided. They could be reduced to a minimum, and in many instances could be dispensed with entirely. The noise of trains, trolleys, and heavy traffic on the streets, while not injurious, and frequently passed without notice by the well, are a source of great annoyance to the sick. Smooth pavements reduce the noise from street traffic, and the more general introduction of self-propelling vehicles will also serve to diminish this source of annoyance. The transference of the surface street-railways to **subways,**

although probably a long way off in the future, will afford much relief from this form of nuisance.

The dust of city streets is both a nuisance and a direct evil. It distributes the pathogenic (or disease-producing) bacteria deposited on streets and pavements by promiscuous expectoration, as well as disseminating the less objectionable horse-manure. The **trolley car** has brought into operation a different but dangerous form of dust, viz., **fine sand-particles,** due to the pulverization of the coarse sand used on wet and slippery rails. These sand-particles not only irritate the lips but also cause irritation of the throat and lungs, leading to a lowered vitality of the mucous membrane lining the respiratory tract and paving the way for subsequent infection by disease-germs. The marked increase in recent years of diseases of the respiratory tract, especially of pneumonia, is very probably in great part due to the influence of dust of this nature.

When these nuisances have been overcome our homes will be much more healthful. The enforcement of laws regulating spitting in public places will markedly reduce lung disease. The perfunctory cleansing of streets in vogue at the present time is attended with clouds of dust along the course of the street-cleaning gang. Instead there should be systematic flushing and cleansing of the streets in such a way as to avoid raising dust and at such a time as not to interfere with traffic. The introduction of underground railways, especially for heavy traffic, will overcome in large part the discomfort and danger from dust generated upon the streets.

Smoke and soot are due to incomplete combustion—they consist of fuel which has not been burned and therefore are not only a nuisance to health as well as adding immensely to the labor of the housekeeper and laundries in towns, but are a source of very considerable loss to the producers of smoke and soot. They are so much fuel thrown away.

The smoke- and soot-nuisance can be overcome to a great extent by proper measures. For those who live near lines of steam railroads or large manufacturing establishments, smoke and soot are causes of great annoyance. Especially is this the case where bituminous, or soft, coal is used. Oil, when not properly used as fuel, may also give rise to smoke and soot. Devices for the consumption of the smoke by the fire under the boiler have long occupied the minds of inventors and many in use are fairly efficient. These serve to remove the greater portion of the smoke and soot, but are not in general use because they increase the first cost of the machinery and in some

cases interfere somewhat with the efficiency of the engine. A proper smoke-consuming boiler should use less fuel and so save money as well as the most objectionable nuisance which is tolerated in towns and cities. This problem still awaits a solution which is applicable under all conditions. The more general use of gas and electricity will do away with the evil in many instances.

House-Cleaning.

"Dirt is matter out of place." Coal in a stove is all right; on the parlor carpet it is dirt. Paint on a house is a good thing; on one's clothes it is most troublesome dirt. The ordinary conception of the word "clean" is quite different from the chemist's idea of the word. To be chemically clean, an object must be free from everything that might interfere with a chemic analysis. The sanitarian's meaning of the word "clean" is, however, quite different from the chemist's, as well as from the ordinary meaning of the word. From a **hygienic** standpoint "cleanliness" means the absence of the specific causes of disease. Looking at the subject from this standpoint, "house-cleaning" should signify **the removal of everything** which is **concerned in the production or spread of disease.**

In actual practice we rarely ever attain the ideal, yet it is essential that the ideal should always be before us so that we may approach it as nearly as may be. In house-cleaning, therefore, it should be our **aim to remove all disease-producing agents** from the premises, as well as those factors which might tend toward the propagation or dissemination of disease. For these reasons **sweeping should not be allowed, except under proper conditions.** All dusting should be done by means of a cloth or sponge, dampened with oil, turpentine, good **soap-suds** (best made with green soap), or plain water or steam. Dusting should be done **before sweeping.** The latter must then be done in such a way as to avoid raising dust. Carpets and floors should always be liberally sprinkled with moist shredded paper (soaked for a few minutes in water and then squeezed and torn into shreds), tea-leaves, sawdust, bran or other means of catching and **holding** the dust. This does not prevent the use of carpet-sweepers.

The great **purifying agents** used in house-cleaning have been handed down to us by our forefathers, viz., **washing-soda, soap,** and **hot water.** These have not been improved upon as to simplicity, efficiency, and cheapness by any of the "scientific discoveries" of late years. Hot soap-suds and hot solutions of washing-soda are effective germ-killers as well as satisfactory cleansing agents. When freely

used they remove many of the disease-producing bacteria, as well as filth, and are all that are required to make a house "**clean**" in the hygienic sense of the word.

In cleaning a room which has been occupied by persons with contagious diseases these simple cleansing agents are usually reinforced by the use of more powerful germicidal (i. e., **germ-killing**) substances. Such a room should first be **disinfected** by means of **formaldehyd gas.** A solution of it in water is termed **formalin** and it may be used on a sheet hung up on a clothesline, on which the formalin is thrown by means of a spraying apparatus. Or the formaldehyd may be used in the form of gas generated in a special apparatus. After the room has been disinfected by one of these methods, and then thoroughly aired, it should be cleaned by the free use of soap and hot soda solution.

Washing and Laundering.—When cases of infectious diseases occur in the household the soiled clothing or bedding of the sick persons should never be mixed with those of the rest of the family. Everything to be washed from the sick-room, as well as the clothing of the sick, **before** it is removed from the sick-room, should be put into a tub or pail or boiler containing water and some antiseptic, such as carbolic acid. It may then be taken from the sick-room. After standing in the antiseptic solution for several hours it may be washed in the ordinary manner.

Clothes-cleaning.—Articles of wearing apparel and bed-clothing that cannot be cleansed by washing must be cleaned by other methods. Such articles as have been exposed to infection should be disinfected by **steam** or by means of **formaldehyd gas.** Steam-disinfection requires a special apparatus, and consequently this cannot be carried out in the home. Most towns and cities have public disinfecting places. Disinfection by means of formaldehyd gas may be carried out in the home. This may be done by sealing up the cracks about all the windows and doors, opening all drawers, trunks, etc., and exposing all bedding and clothing; then set a pail in the middle of the room and in it put half a pound of permanganate of potash and on this pour eight ounces of formalin. (These are the quantities for 1,000 cubic feet of space.)

The unwashable articles may of course be disinfected by hanging them up in the sick-room during the disinfection of this in the way described above.

Woolen clothes, blankets, bed-spreads, and furs should be cleansed regularly by measures directed toward the removal of grease and

filth. Simple airing is insufficient for satisfactory cleansing. Exposure to fresh air and sunshine is of great service in purifying such articles, but fails to remove dirt and grease. The latter should be removed by means of naphtha, benzine, or gasoline, with the proper precautions against explosion. Grease is freely soluble in these liquids, and they may be applied to delicate fabrics without injury. They may be used with a sponge or cloth, or the articles may be immersed in a quantity of the liquid. For really good results it is necessary to rinse the articles in a second quantity of the fresh naphtha, benzine or gasoline, as the first named now contains grease in it. After having been cleansed thus, the articles must be aired for some time to dry and allow the cleansing liquid to evaporate. After aëration for a day all odor of the liquid will have disappeared, and the articles are then ready to be pressed with a hot sad-iron. When cleansed by this method and properly pressed afterward, the articles will appear almost like new and will show no trace of the process they have passed through. This is known as "dry-cleaning," because no water is used. Much of the so-called "dry-cleaning" is done, however, simply with soap and water properly used. It is necessary to be extremely caûtious in the use of all these cleansing fluids, as they evaporate rapidly, and, mixing with the air, are highly inflammable and explosive. **The cleansing operation should, therefore, always be performed in the open air, or at least in a room in which there is no artificial light or fire.** It is dangerous to use any of these liquids, even at a considerable distance from a flame, because the vapor from them will mix with the air and float across the room to the fire and cause a terrible explosion and fire.

PART THREE—*Dietetic Guide*

Life Giving—Body Building Foods

Subject Reference

For Hygiene of Digestive System, see pages 127-147.

For Special Diets for Various Diseases, see pages 319-348.

For Principles of Nutrition, see Vol. 2, pages 648-679.

A Factor in Disease and Health.

SPECIAL DIETS FOR

Obesity, Diabetes, Gout, Gravel, Rheumatism, Scurvy, Scrofula, Consumption, Anemia, Nervous Prostration, Neurasthenia, Fevers, Dyspepsia, Biliousness, Torpid Liver, Diarrhea, Constipation, Brights Disease, Heart Disease, Bronchitis and Asthma.

NOTE:—The Majority of So-called Diseases Caused by Wrong Eating and Drinking Can Be Cured by Correcting These Errors.

INSTRUCTION EIGHTEEN—*Introductory*

This section is intended to be a practical dietetic guide to the invalid, and it is hoped that here the reader will find the food problem stated, not merely in terms of carbon, hydrogen, and nitrogen, etc., but in the form of actual dishes which will prove both digestible and palatable. Following the dietaries are the recipes for all the dishes named.

No hard and fast line can be drawn between health and unhealth. So true is this that such conditions as **old age**, in which the powers are failing, and **infancy and childhood**, in which the powers are not yet fully established—i. e., have not become **stable**, or set—may with propriety associate themselves with the multitudinous forms of failure to reach the standard of health, or of actual departure from this standard. **Health, briefly defined, is life at its highest**; disease, **unhealth,** or the invalid state, is life at every level below this.

For convenience' sake individuality has been accorded to states of unhealth which, broadly, present definite characters, and these constitute the long list of diseases. So far as is practicable, there are selected from this list the more important members—at any rate, those which may serve as types—and an endeavor is made in each case to state clearly the principles on which the dieting should be conducted, and then to give examples of these principles.

A treatise in the present small compass cannot present the

reader with dietetic intricacies, but must restrict itself to teachings which are more general. If these fail, the diet must be changed unhesitatingly and the body humored, however unorthodox or whimsical in its tastes. The science of diet has yet to be written; till that time we must leave room for the palate to choose, and admit the fancy diet.

Much will be found here that is of the first interest to every housewife or person who has to prepare food for the table. The recipes themselves are for dishes in nearly all cases suitable for the table of healthy people, and in these will also be found much valuable instruction in the practice of general cookery. We may instance the preparation of tea, coffee, soups, etc., etc.

At the end there will be found a number of recipes for the preparation of foods suitable to illness in its more acute stages; these constitute "liquid or slop diet," and may be used if it be necessary to feed the patient before the arrival of the doctor; also, with his sanction, selection may be made from these during the course of the illness.

With this exception, no attempt is made to guide the feeding of the sick: this must be in the hands of the medical attendant. Very curious notions prevail among the uninitiated in this respect; and the doctor who diets his patient and omits the prescription is apt to incur serious risk to his reputation. **Yet the diet may be alone at fault, and simple regulations as to this all that is needful.** The days of our Fairy Tales are not quite forgotten, and, when all is said and done, the most matter-of-fact amongst us dearly loves a little mystery. Drugs have their place, and, in our opinion, a most important place; but diet in all cases takes precedence. As a rule people have a great deal too much faith in the power of medicine. They think—or act as if they thought—that they may break all the rules of health and presently be given some medicine which will make their stomach, liver, heart, and kidneys new. This is most unfortunate. You can have no dispensation for sins against health. Sooner or later the penalty must be paid and your faith in medicine may only be leading you on into certain loss of health.

The recipes of all the dishes are given on pp. 349-403.

OBESITY.

This condition is midway between health and disease, and it is not possible to draw the limiting line between these two: we may therefore, with advantage, take obesity first. We do not know why, upon the same diet, one organism grows fat whilst another keeps

spare. We are familiar with another fact of the same order—viz., that lean people are often large eaters, whilst fat people are frequently moderate, even small, eaters, and we are equally at a loss for an interpretation. Further, it is not uncommon to find stout people active, quick both in mind and body. From a consideration of these points we are necessarily led to the conclusion that the accumulation of fat in the tissues is an **inherent tendency** of some organisms, and is an expression of its health. This we must always have in mind: and both before and during any treatment for obesity which we may undertake, we should carefully observe the signs of vigor, evidenced by mental and bodily activity, by cheerfulness, enterprise, etc. Should these improve, well and good: we are justified in proceeding; but should they slacken at all, we must reconsider the question of treatment, and ask ourselves whether, after all, the encumbrance of fat is not the least of the evils before us. Only in cases in which the loss of flesh proves an **advantage** is it permissible to try to reduce the weight of the body.

Again, before we accuse the **diet** as the cause of obesity, we should make sure that other influences are not at work—i. e., **over-indulgence in sleep, insufficient exercise.** We may next proceed to revise the diet upon the following lines:

(1) Greatly restrict the use of the **bread, rice,** and **potato** class; withdraw the dried **pulses** and the use of the **sugar** group. The forbidding of sweet wines, sweet ales, stout, and porter are among the sugar restrictions, and the same holds for sweet fruits, fresh or dried, and sweet vegetables. Starch-containing fruits—e. g., bananas—are not advisable.

(2) Limit the consumption of fat: butter, cream, the fat of meat, and fat-containing flesh generally, whether of beast, bird, or fish.

(3) Limit the amount of liquid taken.

The question of restriction, or rather the extent to which this must be practised, will vary with each case; experience only can determine this. Strictness as to No. 1 is of the most importance; some, indeed, relax or dispense with No. 2, and some relax as to No. 3. One authority admits of free taking of liquids, but is strict as to Nos. 1 and 2; and another well-known plan of treatment recognizes abundant drinking of hot water, with limitation of the food to rump steak and cod-fish.* The severer restrictions—which should not be practised except under advice—may often be intermitted for long periods.

* A tumblerful of hot water towards the end of each meal sometimes aids effectually a revised diet.

It is well, according to some authorities, not to be too abrupt in the transition from the accustomed to the modified diet, and this will be wise if we are acting on our own responsibility.

We have spoken of **restriction,** not abstention; for we do not advocate, even as to No. 1, that the bread-rice-potato group should be **wholly** eschewed. Thin dry toast in small quantity, rusk, some light and plain biscuit, also in small quantity, may represent this group. Any of the so-called diabetic bread preparations (see "Diabetes") are of course allowable. Sugar and sweet foods of all kinds we shall certainly avoid: these are luxuries, not necessaries. **Saccharine** may do duty for sugar, or **glycerine** will furnish the sweetening. Milk and butter may be used in moderation: to take cream would be malicious. In spite of these qualifications there will yet remain a fairly ample dietary, which we may illustrate by the following examples:

DIET FOR OBESITY.

(The recipes for these dishes are given at pp. 349 and following.)

First Day.—*Breakfast:* A large cup of tea or coffee, without milk or sugar; tomato and egg on dry toast; plain biscuit, or rusks, with a very little butter. *Luncheon or Supper:* Cold meat and salad; cheese and rusks. *Dinner:* Filleted sole, with brown piquante sauce; a slice of meat from a roast, or fillet of beef sauté; cauliflower; fried celery; baked apple and rusks.

Second Day.—*Breakfast:* A large cup of tea or coffee, without milk or sugar; fillets of haddock; dry toast with a little butter. *Luncheon or Supper:* Oyster and brown bread, with a little butter, or omelette soufflée. *Dinner:* Clear soup; a slice of meat from a joint, or fried chicken with chives; rusk or toast; asparagus; raspberry jelly; cheese; celery or lettuce and plain biscuit.

These menus may be repeated with variations from day to day as allowable under the general directions preceding.

DIABETES MELLITUS; OR THE SUGAR DIATHESIS.

This disease presents no real affinities to the condition just discussed—viz., obesity: indeed, in a sense, the two states are diametrically opposed; for whereas in diabetes sugar and substances chemically allied to sugar are not utilized by the system, but escape at a loss to it, in obesity these same substances are too well utilized, and are stored up to its encumbrance. Diabetes cannot, however, be regarded as a mere negative disease—an inability to assimilate certain principles—for, unquestionably, in the majority of cases the sugar-yielding group acts as a positive poison to the system, and promotes the disorder. The vice may in certain cases attain to such a degree, that by an intricate chemistry sugar may be formed even from the

nitrogenous or albuminous group. It need hardly be said, that where this obtains, the case assumes a very threatening aspect.

The dietetic treatment of diabetes is of the first importance, and in many cases the disease can be held in check by this means alone; but in no other disorder are the resources of the cook more severely taxed. The problem before him is to hide the absence of starch, or, harder still, to reconcile the patient to its absence. Under the circumstances, unless the patient's good-will and powers of self-restraint co-operate in carrying out the necessary observances, it will be useless to attempt the task.

There are two classes of diabetics: in the one the subjects are younger, on an average, and the symptoms, including emaciation, are more pronounced; in the other class, the patients are more advanced in years, and they are not infrequently inclined to corpulency, and, indeed, suffer but slightly from the disease.

The regimen in the former of these two classes will need to be much more strict than in the latter, but even in the former, tentative procedures—dietetic experiments, in fact—will be necessary in each case; for till we try, we cannot possibly know the degree of starch or sugar toleration of the individual. These powers, it would seem, vary very greatly. It will be obvious, then, that a hard-and-fast routine treatment of all cases of diabetes will be very ill-advised. In the following we shall present the severer restrictions, since the milder will simply mean a more or less relaxing of these: for which, however, medical authority should at all times be responsible.

For practical reasons, diabetes may conveniently be placed next to obesity, since the restrictions in each case concern chiefly one main group of aliments—viz., those containing starch and sugar.

From the regimen of the diabetic we shall accordingly **exclude**:

(a) The entire bread, rice, and potato group.

(b) Sugar, and sweet foods of all kinds. **Saccharine** may be used to sweeten tea or coffee.

(c) The pea or pulse group, in the dried and even in the young state.

(d) Root vegetables, the whole group.

(e) The Spanish onion.

(f) The tomato. (?)

All sweet fruits will be excluded by (b).

From the list of animal foods we must exclude:

(g) The liver of animals, and, because of the magnitude of this organ in them, the shell-fish: oysters, cockles, mussels, etc. For the

same reason one authority excludes the pudding of crabs and lobsters.

(h) Milk may be allowed in **limited quantity,** but, as far as possible, it should be replaced by cream.

From the list of drinks we shall exclude:

(i) Port and all sweet wines; sweet ales and porter or stout; rum and sweetened gin, or any form of sweetened spirit—e. g., liqueurs.

As to what is permitted, we might say briefly that this includes all that which is not excluded, but we shall do well to specify a little more:

(1) The bread, rice, and potato group is replaced by various **gluten** preparations—viz., gluten bread, biscuits, cakes, puddings, and bran cakes; almond rusks and cakes; bread made from the Soy bean. Ordinary bread, cut into thin slices and thoroughly "torrefied" (charred), is sometimes permitted.

(2) Sugar is, or may be, replaced by glycerine, or, better, by saccharine.

(3) The vegetables permissible include the green vegetables, whole group; the salad group, cooked or fresh. Further: cucumber, marrow, seakale, asparagus.* Mushrooms are allowed.

(4) Nuts, except chestnuts, are allowed.

(5) Cheese and butter are permissible, but milk only sparingly; fat and oil are beneficial.

(6) Eggs.

(7) Butcher's meat, poultry, game, fish, and broths or extracts from these, **unthickened**, are all permitted.

(8) To drink we have: Tea, coffee, cocoa from the nibs, chocolate made with gluten meal.

Soda-water and the table mineral waters.

Dry sherry, claret, Burgundy, or dry Sauterne, hock.

Bitter ale.

Brandy and whisky.

Water acidulated with cream of tartar makes a pleasant thirst-quenching drink.

DIET FOR DIABETES.

First Day.—*Breakfast:* Tea or coffee, sweetened with saccharine, and flavored with a little cream; mutton chop; bran bread, or gluten bread; small salad. *Luncheon:* Vegetable marrow, with savory mince; bran bread; savory or almond

* According to one authority, such vegetables as Brussels sprouts, cauliflower, broccoli, French beans, marrow, seakale, asparagus should be boiled in much water before eating.

custard. *Dinner:* Clear soup, with poached eggs floating in it; partridge, braised, with cabbage; cheese; bran or gluten bread.

Second Day.—*Breakfast:* Tea or coffee, as above; café noir with or without saccharine; kidney and mushrooms; bran bread; almond biscuits. *Luncheon:* Cold beef and cucumber; gluten bread; almond biscuits, with butter and salt. *Dinner:* Baked plaice; veal à la Talleyrand, or hot meat from a joint; seakale; gluten or bran bread; calf's foot jelly in glasses; walnuts or almonds.

Alternate and vary these menus. The *weight* of the patient should be watched. It is permissible to gradually introduce starch foods after a time, watching the result. Part of a well baked potato may be added first to the dinner.

THE GOUTY HABIT.

We need not concern ourselves precisely with what is meant by the word **gout**, for in so doing we should run the risk of raising a cloud of disputants, without the likelihood that any further light would be thrown upon the subject itself. If, however, we state the case broadly, and declare gout to be a vice of the system, specially affecting the uric acid exchange, and showing itself by depositions of this material (chalk stones) in the joints and fibrous structures of the body, with the liability to inflammatory attacks in these same parts, all will agree that we have described a salient feature of gout. For other symptoms and features of gout—and their name is legion—we must be content to relegate them to the doctor. Let him make the diagnosis, and then approve of our diet list.

Uric acid is a nitrogenized body, and in gout we have, therefore, a disturbance of the nitrogenous waste of the system; but it does not follow that **only** the nitrogenized aliments will cause or share in this perturbation, and experience teaches us that this actually holds. However, having first made sure that **inactivity**—enforced, as from sedentary occupations, or the result of indolence simply—is not the cause of the gout present, and that correcting this bad habit of lack of exercise does not remove the disorder, we shall proceed to diet the patient, and shall begin by lessening the amount of animal food: i. e., lessen the nitrogenized income. There is no evidence that the albuminous constituents of animal tissues favor gout more than the same constituents of vegetable tissues; and the restriction of animal diet is because of the percentage richness of proteids in the former, and for no other reason.

We then proceed to **curtail** the consumption of starchy and sugary compounds: these bodies are supposed to interfere with the complete breaking up of nitrogenized compounds.

Thirdly, we keep an open mind as to the admission of fat to the

dietary: allowing it in moderation in those cases where it agrees well, but keeping its use under careful observation.

Fourthly, we watch with grave suspicion the consumption of alcohol, forbidding absolutely the sweeter wines—in particular, port—the sweeter ales and beers, and sweetened spirits. If permitted, the gouty subject should choose from among the following: a dry sherry, a sound claret, whisky; and of these he should partake in very great moderation, if at all.

We should add, that some authorities lay more stress on the restriction of sugar and starch than upon that of animal food itself, and that some condemn strongly the use of fat.

But upon most points, with the exception of the alcohol question, we are concerned with restriction—**curtailment** rather than **exclusion**; and, indeed, the key-note to gouty treatment is **moderation.** Individual treatment is very important, and we must argue **ad hominem** rather than **ad gentem.** Further, as one author says, we shall have to consider "very often more the man than the ailment," or here as everywhere in the treatment of disease, "Treat the **patient** rather than the **disease.**"

The regimen as thus sketched out will be very much upon the lines of the treatment of obesity, but it will differ from it in the restriction of animal foods, and in the yet more cautious use of alcohol. There remains to mention that gouty people are in general dyspeptics—or, at any rate, that dyspepsia plays an important part in gout. For this reason it is necessary to select the foods according to their digestibility (see section on Dyspepsia). We now accordingly lay down the following dicta:

(1) **To limit the bread, rice, and potato** group, and in particular to avoid all forms of pastry and all cakes. Bread in the new state is unsuitable; dry toast, rusks, plain water biscuits (also any form of diabetic bread) will be the best to select from.

To avoid **sugar** and **preserves of all kinds,** also sweet dried fruits.

(2) Of vegetables, to select the cabbage tribe in all its variety, and the salad group, as most suitable; but the fruit vegetables may be tried, including even the tomato and the cucumber; the latter if well boiled. Seakale and asparagus may also be tried. Fresh fruits to allow as freely as the digestion will permit: bananas and plantains. Yams are not suitable. Nuts as a class are too indigestible.

(3) Fats and oils, so far as they are tolerated, to be allowed; but foods soaked or cooked in fat or oil, being mostly difficult of digestion, to be disallowed.

(4) Butcher's meat to be represented by mutton or beef—preferably the former. Pork, veal, cured meats, potted meats not allowed. Bacon toasted or boiled generally suits. Game or poultry permissible. **Butcher's meat at most once a day.**

Fish: the white kinds allowed.

(5) Milk to be admitted freely; butter and cream cautiously; cheese to be avoided.

(6) Eggs not very suitable.

Plain cooking is indicated; highly-spiced, elaborate, tasty dishes should be avoided.

(7) Alcohol (see above); tea and coffee, if they agree; cocoa, especially that from the nibs, will in other cases be the substitute. The table mineral waters very suitable.

DIET MENUS FOR GOUTY HABIT.

First Day.—FRESH FRUIT.—*Breakfast:* Weak tea or cocoa, made from nibs, without sugar, but with milk *ad lib*; haddock, plainly boiled; dry toast (eaten with a very little butter). *Luncheon:* Rice pudding, with stewed apricots; bread; milk, or some mineral water, with one or two tablespoonfuls of whisky. *Dinner:* Boiled fillets of whiting; a slice from a joint of mutton or roast ptarmigan on toast; broccoli; bird's nest pudding, with milk; rusks; potash, soda, or seltzer water, with one or two tablespoonfuls of whisky.

Second Day.—FRESH FRUIT.—*Breakfast:* Weak tea or cocoa, made from nibs, without sugar, but with milk *ad lib*; bacon rashers; stale bread or thin dry toast. *Luncheon:* Baked sole; bread; sound, ripe fresh fruit. *Dinner:* Vegetable marrow soup; a slice from a joint, or boiled fowl or chicken, with mushrooms; spinach; hydropathic pudding; fresh fruits.

Alternate these menus and vary them by using other vegetables, meats, etc., as allowable in accord with the general directions preceding.

GRAVEL AND STONE.

In these disorders the same substance which in gout tends to separate within the tissues of the body, tends here to separate within the urinary passages; but this is a very important distinction, since the precipitation within the urinary passages is, physiologically considered, outside the tissues. What the exact relationship is between gravel and gout is not very clear, but they are certainly not two forms of one and the same thing. However, the fault in each case is an excess of uric acid, and, provisionally we may therefore apply the same dietetic treatment. We shall, hence, exercise especial caution in the use of alcohol, sugars, starches, and fat; and we shall restrict the use of animal food. In both gout and gravel we ought to start with a prejudice against **fat.**

DIETARY FOR GRAVEL AND STONE.

First Day.—*Breakfast:* Tea, coffee or cocoa, made from nibs, with milk *ad lib* (all without sugar); stewed mushrooms; dry toast or stale bread and butter in moderation. *Luncheon:* Sole on toast; baked apple; rusks. *Dinner:* A small slice from a joint, or sweetbread; one potato baked in its skin; turnip tops; blancmange made with skimmed milk; celery or plain salad, with water biscuits and a little butter.

Second Day.—*Breakfast:* Tea, coffee, or cocoa, made from nibs, with milk *ad lib* (all without sugar); rasher of bacon; dry toast or stale bread and butter; tomato sandwiches. *Luncheon:* Filleted plaice, baked; sago shape; small biscuits, with very little butter. *Dinner:* A small slice from a joint, or minced collops; rice served as a vegetable, plain boiled; greens; apple mold; Devonshire junket; cheese (such as brie or Camembert), with watercress and plain biscuit.

RHEUMATISM.

This includes more than one disease. Here we mean by it not acute rheumatism (rheumatic fever) nor rheumatic gout (rheumatoid arthritis), but the chronic disease with pain and stiffness in one or more joints or in certain muscles (muscular rheumatism), of which lumbago is a common form.

This disease is very common, but the diagnosis should be sure before treatment is begun, just as in the case of any other disease.

The diet in rheumatism will resemble that in gout in the avoidance of the sugar group: sweet foods, sweet drinks, and, in particular, the sweeter, more fruity wines, and the more full-bodied ales and beers. This will be the chief abstention. Unsweetened spirit, preferably whisky, is the best form of alcohol.

The bread, rice, and potato group is allowable in moderation, and so far as the digestion can cope with it. Rheumatic subjects are often the victims of acid dyspepsia, and must, on this account, be cautious in the use of this group. In any case, no forms of pastry or cake are allowed.

Fats, so far as they are assimilable, appear to be beneficial. We should, indeed, rather press this group.

Albuminous foods: Meats should be taken in moderation, and plainly dressed. We should restrict the quality perhaps more than the quantity—e. g., of fish, allowing the lighter kinds, white; of birds, the white-fleshed poultry and game (wild-fowl are less suitable); of meats, mutton preferably; and of the special parts of animals, tripe, sweetbread, brains, calf's head, calf's feet will be found suitable. Cured meats should not be eaten. Eggs and milk may be taken without restriction.

We have said nothing about vegetables and fruits. These may be enjoyed in the fresh state, with few exceptions; of the former, it is well to avoid carrots, and parsnips, and beet, and to be cautious with the group of the fruit-vegetables; of fruits, avoid those which require sugar as an accessory, unless we are content to forego the sugar; also plums and cherries. Preserved and dried fruits are not advisable. The presence of dyspepsia—as stated, a not infrequent accompaniment of rheumatism—will involve, on its own account, other restrictions.

Rheumatism is found among the fleshy or those of full habit and the generous-living, but it torments also the ill-fed and ill-clothed; and whilst the former will require a more abstemious mode of living, the latter will need feeding-up, but this may be done on the lines just mentioned.

DIET FOR RHEUMATISM.

First Day.—*Breakfast:* Tea or cocoa, with milk but no sugar; ox eyes (baked egg on a round of toast); toast or stale bread with butter; a baked apple. *Luncheon:* Boiled tripe; onion sauce; potato, boiled, baked or roasted. *Dinner:* Julienne soup; marengo of chicken; fried potatoes; cauliflower with sauce blanche; lemon rice pudding.

Second Day.—*Breakfast:* Tea or cocoa, with milk; bacon; toast with butter; fresh fruit. *Luncheon:* Savory omelette; apple snow and milk. *Dinner:* Boiled turbot; loin of mutton, boned and rolled; browned potato; seakale; ladywell pudding.

RHEUMATIC GOUT.

This is a painful affection of the joints, sometimes acute but more often chronic. It causes more or less deformity and permanent immobility of the joint. It is not like gout at all, and requires very different treatment; nor is it really a kind of rheumatism; only these three diseases affect the joints.

In treating it, the great point is not to use any kind of lowering treatment (which, however, is right in true gout). The diet must be a generous one and may include stout or porter. **Fats are of special value.** The diet suitable is the same as for rheumatism without its restrictions—in other words, it is a full diet, with plenty of fats. By "generous diet" here we do not mean over-indulgence. Pastry especially and sweets must be used in moderation, although sugar may be used to sweeten such foods as it is desired for.

DIETARY FOR RHEUMATIC GOUT.

First Day.—*Breakfast:* Tea, coffee, or cocoa, with plenty of milk; baked fresh herrings; dry toast, or stale bread with butter; baked apples. *Luncheon:* Chop;

tomato salad; savory omelette. *Dinner:* Fried sole; braised mutton; Jerusalem artichokes; cabinet pudding.

Second Day.—*Breakfast:* Tea, coffee, or cocoa, with plenty of milk; buttered eggs; sardines; toast; butter; stewed prunes with or without cream. *Luncheon:* Beef stew; cheese. *Dinner:* Ox-tail soup; broiled chicken; potato puff; spinach; rice with apricots.

These various dishes are to be varied by others of suitable kind, from day to day.

RICKETS.

This affection does not represent a vice or tendency of the system, but, rather, it is the outcome of a vicious method of bringing up. The dietetic problem is to substitute a healthy regimen for one that is unhealthy, at the same time that the ill-effects already produced are combated in other ways.

Rickets belongs essentially to childhood—a time of life when simplicity of diet should be adhered to, and foods require little preparation beyond the right degree of cooking. Elaborate diet tables are therefore not required, and for this reason, as well as the further reason that the case of rickets should be under the doctor's care, and not leave his hands until cured, we shall pass it over.

It should be added that bad hygiene of all kinds, and all agencies tending to depress the health, may probably engender rickets, so that the disease needs attention from this side also—indeed, must be attacked all round.

SCURVY.

As in the case of rickets, we have here to deal with the results of dietetic error, and not with any constitutional predisposition. Scurvy is very greatly a disease of the past, and it was incidental to prolonged sea voyages, and circumstances of whatever nature which made difficult the obtaining of fresh food, both animal and vegetable.

The production of scurvy was an experiment in dietetics which at one time was made on a large scale. Now its occurrence belongs to the rarities; but every now and then—especially in large towns—human beings are found ignorant of the first principles of feeding, and in themselves or in their children they may produce scurvy. Sometimes it is the misfortune of the dietetic possibilities or impossibilities, rather than any fault of the individual.

The cure of scurvy needs no diet tables: the readmission of fresh food—animal and vegetable—to the dietary suffices so far as feeding can cure; what remains over and above belongs to the doctor.

To a condition met with in childhood, and presenting some of the features of both scurvy and rickets, and named scurvy-rickets, similar remarks will apply.

SCROFULA, CONSUMPTION, ETC.

With these affections we return to diseases which are the result—in part, at any rate—of a predisposition of the tissues—of a vice of the system. However we may look at this question, and whatever credit we may give to modern developments of the tubercle bacillus theory, it becomes abundantly evident that it takes two to play at the game of scrofula, or tubercle—the bacillus on the one hand, undoubtedly, but as undoubtedly the tissue tendency or lack of resistance on the other.

These diseases are marked by the occurrence of yellowish nodules in certain of the tissues. The tendency of these nodules is towards softening, with breaking down of the tissues in which they are embedded. The lymphatic glands may be involved, causing the so-called "kernels" or "cold abscesses" of scrofula. Disfiguring scars often mark the site of past ulcerations caused by such. The bones and joints may be implicated, and bone and joint disease result, giving rise to "white swellings." The lungs may be the seat of the mischief, and pulmonary consumption ensue. Other parts of the body may suffer, but scrofula and consumption are the best and most familiar examples of this **tuberculous** affection.

Of the two factors concerned in the production of tubercle, we shall with difficulty escape the one—the bacillus—though, by hygienic measures, we may much diminish the chances of infection; but as to the other factor, we may hope, by a careful building up of the tissues, even after the invasion of the body, to enable the organism to withstand or overcome the poison.

In the front rank of measures adapted to this end is a suitable dietary. This should be mixed, and as generous as the patient can take. Again we must warn, that by this we do not mean highly-spiced and rich foods, with pastry, cake, etc.—the plainer the better, so long as the patient partakes satisfactorily; but patients of the consumptive class are often extremely fastidious, and little dishes as tempting as possible may be called for. We would warn against the free use of pepper and like condiments, inasmuch as the larynx or voice-box may share in the affection, and the act of swallowing be the more likely to provoke a cough if the food be at all of an irritating character.

Such laryngeal irritability will be absent in many cases of consumption, but when present and excessive it will demand direct medical treatment. It will be found in such cases that soft foods—e. g., gruel, arrowroot, soft milk-puddings, thickened milk, jellies, etc.—are easiest swallowed.

There are no special avoidances in the dieting of the scrofulous and consumptive. From each class we may select and get as much variety as we can, and, if need be, the help of wine, beer, or spirits may be called in to assist the appetite or to stay the stomach.* There are, however, special indications for **fats** and **fatty foods** to the extent of their tolerance—butter, cream, etc. Should the diet not agree, we may, by the aid of a ferment—e. g., pancreatine in some of its many preparations—help out the digestion. The use of the ferments is a growing one, though it hardly yet belongs to the kitchen.

Of great value in the treatment of all forms of tuberculous disease is milk, but it should be given in large quantity, and it should be added to, not taken in the place of, other food. Thus "one to two glasses of milk may be taken during and shortly after each meal;" and in many cases, especially of consumption, a glass of warmed milk, with or without a little rum or brandy, will be of great value in the early morning, about five or six. This early hour is often a period of great physical depression.

Consumptive patients often suffer from alimentary complications—irritable stomach, diarrhea, etc.—but the treatment of these, from a dietetic point of view, will differ in no wise from the treatment of like conditions in non-consumptive people, and, moreover, these complications will mostly call for direct medical supervision; we shall therefore pass them over here.

If there be any tendency to feverishness, this will, in the great majority of cases, tend to show itself towards the late afternoon or evening. In such cases it will be well to make the more substantial meals in the morning and at mid-day—i. e., during the absence of fever. If there be any degree of fever, the case needs medical supervision, and should have received attention earlier. It is much like a conflagration which is easily extinguished soon after it begins, but when the flames break out ("fever") is sure to do much damage if not cause complete destruction of the building.

---

* Where wine and beer cause much pain in the act of swallowing we should dilute the wine with water, and we may give it warmed—the beer also should be tried warmed.

DIETARY FOR SCROFULA, CONSUMPTION, ETC.

First Day.—*Breakfast:* Tea, etc., with porridge and milk; kidneys and bacon; savory eggs; toast; baked apple. *Luncheon:* Sausage cakes, with savory rice and apple sauce; little batter puddings. *Dinner:* Haricot soup; cutlets à la réforme; potato snow; vegetable marrow sauté; amber pudding.

Second Day.—*Breakfast:* Tea, etc.; porridge; mutton collops with tomato; cream toast. *Luncheon:* Oysters and brown bread; baked princesse pudding, with cream. *Dinner:* Fillets of sole, with maître d'hôtel sauce; grenadines of veal, larded; potato cakes; asparagus; chocolate pudding; custard sauce.

ANEMIA.

The name signifies lack or poverty of blood; but whilst a variety of causes may bring the condition about—e. g., loss of blood, exposure to unhealthy conditions of life, improper feeding, etc.—it is not necessary that there should be any inherent tendency in the organism towards a faulty blood formation. Cases where this tendency is absent recover for the most part quickly when they are placed in favorable circumstances. On the other hand, certain cases of anemia have an inherent defect in the powers of assimilation and of blood-making, and they tend to develop under conditions not in themselves unfavorable to health.

These cases—sometimes called essential anemias—may be very obstinate, and may demand special methods of treatment, both dietetic and medicinal. In the nature of their treatment the dietetic means adopted will be very similar to that employed in those cases which have a sufficient cause, and may therefore be styled secondary.

Most cases of primary anemia are innocent enough, however troublesome; but certain cases show a progressive character, from bad to worse, and are so fatal in their tendency that they are named "pernicious." This minority of cases are probably fundamentally different from the great majority, and we shall relegate them absolutely to the medical man's care. The following remarks will not apply to them.

The cause of anemia appears to lie immediately in a deficiency of iron in the blood, and this deficiency itself seems to depend upon a faulty assimilation of the nutritive principles supplied to the body. These nutritive principles contain iron, and the deficiency of this element in the blood may be in spite of an abundance of iron in the food: the organism, so far as iron is concerned, starving in the midst of plenty. Very frequently digestive disorders coexist, and these may in part explain the faulty assimilation. The digestive disturbances may require special dietetic and drug treatment, but inde-

pendently of such local treatment, which is more or less temporary, and independently of general treatment by hygienic measures—by rest in bed, if necessary, etc.—we may note the following points as to diet:

(1) That the regimen should be as full as the digestive powers can manage, due regard being paid to the **digestibility** of the dishes.

(2) That variety is desirable, but that we should tend to accentuate the administration of albuminous foods, and should also seek to give fats, especially if there be wasting as well as anemia. Fresh green vegetables are also advisable.

(3) That the dishes should be tasty and attractive, without being rich or highly spiced. The free use of salt and the moderate use of condiments and flavoring agents seem useful. More incentives are required by an alimentary tract lacking in tone than by a healthy tract.

(4) The use of alcohol in moderation, in the form of wines (not beers, because of the dyspeptic tendencies), may be expedient. Stimulants taken thus will belong to the class of incentives, and they must be taken either with food or immediately before it. Great care is always necessary in such cases, especially in the female sex, not to establish the alcohol habit.

Cases needing complete rest in bed and frequent administration of food in excessive quantities will not be considered.

It will be seen from the above that, provided we keep to the more digestible forms of butcher's meat, birds, fish, and farinaceous foods, and are careful that all flour preparations are thoroughly cooked by boiling or baking (which practically means the exclusion of cakes and pastry of all kinds), and that vegetables of all kinds are thoroughly cooked, we do not need to be much more explicit. **The limits of administration are the limits of a digestion lacking in tone.** (Consult later the section on Dyspepsia.) Beside the ordinary meals composed as above, the **addition** of milk to the dietary—say, a tumbler after each meal—may be tried.

As to suitable forms of alcohol, we would recommend a good claret or Burgundy, or a small quantity of whisky, with water.

In most cases a course of medicinal treatment will be necessary, and artificial aids to digestion may also be required.

DIET FOR ANEMIA.

First Day.—*Breakfast:* Tea, coffee or cocoa, with plenty of milk; buttered eggs; toast; tomato salad. *Luncheon:* Mutton stew, with vegetables; creamed rice,

boiled; stewed rhubarb; milk. *Dinner:* Tomato and turnip soup; rump steak; fried potatoes; cauliflower; blanc mange, with cream.

Second Day.—*Breakfast:* Tea, coffee or cocoa; chicken livers and bacon, or toasted bacon and a soft-boiled egg; toast and butter; stewed prunes with milk. *Luncheon:* Tripe à la Coutance; creamed rice, baked. *Dinner:* Boiled halibut; parsley sauce; plain mutton; baked potato; apple Charlotte.

NERVOUS PROSTRATION, "NERVES," NEURASTHENIA.

These terms may be taken as equivalents: they represent less a tendency or vice than an actual condition produced, and this condition is one of exhaustion—of a ruined exchequer. The cause, we shall readily believe, is prolonged strain or intensity of strain, no matter of what kind.

Nervous prostration manifests itself in a great variety of ways, and chiefly in a want of stability or balance of the nervous system; hence arise the manifold forms of hysteria, the neuralgias, the inertias; and in such states so commonly originate the habits of drug-taking—alcoholism, morphinism, etc.

Sleeplessness is a very troublesome symptom in this disease, and herein lies the danger of the habitual taking of sleeping-draughts. The seriousness of this condition consists, therefore, as much in the temptations which it brings as in the complete unfitting of the subject for the duties of real life. In this state naturally kind-hearted people become self-centered, and their moral being crystallizes in sharp-pointed needles of pure selfishness, which wound in particular the inmates of the home. These crystals, by-the-by, grow most readily in the medium of home life.

There is a good, healthy form of hysteria, or "nerves," which well becomes the subject, the physical condition being excellent. For this the heated poker is the type of treatment. But there is another form, in which the patients are thin and obviously exhausted, and in whom, therefore, a real basis of physical depression exists. This must be treated; and till we attack this stronghold it is useless to preach morality—not even the outworks will be thus gained.

First and foremost in the treatment of this condition comes diet, though, in severe cases, yet earlier will come the complete removal of the patient from home surroundings. Isolation, rest in bed, frequent feeding with excessive quantities—these means have become familiar to us; but short of such extreme measures, we may in milder cases endeavor to feed up the patient to a higher level of vitality.

One cannot say exactly that a special dietary is needed in these

cases, the simple prescription—"feeding up"—indicating sufficiently the requirements; but we may add that the use of meat and of meat broths should be prominent: thus, soup or meat broth twice a day, and meat at least once, will be advisable. We shall thus secure that the dietary is stimulant.

The intervals between meals may require to be broken in these cases, and a cup of warm or hot milk or cocoa taken in the early morning, if the patient wakes early; also something about eleven in the forenoon, again in the afternoon, and the last thing at night.

The moral of this section is that "nerves" in general may mean that the sufferer has been allowed to lapse into a low level of alimentation, and that a judicious raising of this—**feeding up**—may suffice to cure the malady.

FEVER (ACUTE OR CHRONIC).

Practically, the dietetic treatment of the acute febrile state will be in other hands than ours, but we may be so circumstanced that for a longer or shorter period the feeding will rest with us. In such cases we shall always administer slop diet—milk or meat broths, or both—and we shall act thus for two reasons: (1) Because the giving of solid food may do positive harm; (2) because it is useless, for the digestive powers, even with moderate fever, are too weak to deal with it, and the food remaining undigested may excite the stomach to vomiting or derange the intestines. As a rule, the patient's own instincts will guide correctly, and lead him to avoid solid food altogether.

On the whole, milk is the best food to give for the time being; and we need only add that if an adult takes and digests three pints in the twenty-four hours, a child one pint and a half to two pints and a half, according to the age, we need not fear that the patient will starve. For the rest, we must refer back to what we have said in our first part as to the methods of dealing with milk and with meat broths. In the case of a short-lived feverish attack occurring in the midst of health, we may safely leave the adult to his own judgment, if it counsel abstinence, for twenty-four hours.

Patients suffering from a fever which periodically remits or intermits, and which is essentially chronic—e. g., consumptive patients and the subjects of malaria—may be able to take solid food with advantage, or may actually require it. The solid food in these cases should be given, as far as possible, during the periods of absence of fever, or when the fever is at its lowest; and if we have

no thermometer, we must look to the well-known symptoms of feverishness to guide us. When the patient feels at his best, we may know he is freest from fever, and that that is our opportunity for more substantial feeding: this, in general, will be during the forenoon.

In the case of malaria patients, it has been observed that starvation treatment adds greatly to the mortality; and whilst, as a general rule, it is stated that the food in these cases should be light and nutritious, it is not uncommon for a sufferer from ague to be able to eat and digest a very respectable meal shortly after recovering from a paroxysm.

We cannot, however, give in any precise form dietaries for chronic fever. In the treatment of consumption as a form of scrofula we have already spoken of the value of fat, and in particular of milk. The patient should be fed as liberally as possible.

Convalescence.

It is impossible to treat of this except in the most general terms. Convalescence is as multiple as disease, and the return to health is by as many roads as the departure from health: each requires a special leading. We can, therefore, only start from slop diet in its simplest forms and advance up the scale to the food of robust health. Put very shortly, we may thus set forth this scale:

Slop Diet.—Milk and meat broths, modified or unmodified.

Farinaceous Foods.—Gruel, arrowroot, etc.; milk puddings, bread and milk, etc.

Eggs, lightly boiled or beaten-up.

Fish.—The white-fleshed, lighter kinds.

Poultry.—Fowl.

Game.—Certain varieties.

Meat.—Mutton.

Vegetables—as accessories, as it were—will in general come in last, though vegetable flavorings—as essences, etc.—may come in fairly early.

Beginning with slop diet, we shall gradually admit or substitute the groups as they succeed each other; but no one dietary can be given as embodying the dietetic treatment of convalescence, since this will differ according both to the stage of the recovery and the nature of the disease from which recovery is taking place.

DYSPEPSIA.

The trouble here is more localized, and it affects the alimentary tract. The stomach may be at fault, or the intestine; or, in addition, the special organs—liver and pancreas—may share in the trouble, and impress their own characters upon the digestive derangement. The teeth are often the root of this trouble.

"Dyspepsia" is not a good term; for whilst it means "difficult digestion"—imperfect coction, as the older writers put it—its etymological signification would limit the meaning to an indifferent peptic action—i. e., to a function gastric, or pertaining to the stomach only. We shall, however, use it here as synonymous with indigestion, in whatever part of the alimentary tract the cause be situated.

The first care in an ordinary case of dyspepsia is to see that no dietetic error is being committed, or improper way of taking food; that the meals are not too much crowded, not too frequent; that the intervals are not broken by the taking of food trifles; that the food is not hurriedly swallowed, and the hasty meal followed or preceded by undue exertion, strain (physical or mental), etc. All these are dietetic errors; and having eliminated these, we proceed to inquire as to the quality and quantity of the food taken, and to amend the dietary.

It is possible to lay down general rules as to what may be taken and what should be avoided. The exceptions to these rules will concern the things to be avoided rather than the things to be permitted; but very occasionally, in cases of idiosyncrasy, so called, an article of diet reckoned amongst the easiest of digestion will prove indigestible. In our scheme we cannot take count of these exceptions: experiment alone can determine them. Everyone must learn by experience what foods agree and what do not, and must be guided by this experience rather than by any set rules or lists.

A dyspeptic should in the first place be cautious in the use of the bread and potato group—thus: bread must be at least one day old and thoroughly baked, to start with. White bread is in general lighter than brown bread (whole-meal), the latter tending in some cases to produce acidity, in the same way that oatmeal porridge does. Bread should be taken in moderation, and thin dry toast, rusk, and plain light water-biscuit will often replace it with advantage. In many cases it would be wise if the patient would substitute in part a gluten bread for ordinary bread.

Some forms of malted bread may be found of use.

All forms of pastry, boiled or baked, and flour preparations, such as batter, must be absolutely forbidden; but well-boiled milk puddings, rice, sago, tapioca, semolina, barley, etc., are admissible.

Porridge does not suit in many cases. Trial of the various kinds may discover one or more that agree and may be used.

Potatoes are best avoided; if allowed in small quantity, they should be thoroughly cooked by roasting "in their jackets."

Sugar and sweet preparations—preserves, jams, etc.—should be avoided; glycerine or saccharine may replace sugar.

The dried pulses are not suitable—they tend to cause flatulence; but the Revalenta Arabica—a food artificially prepared from the meal of lentils, beans, and peas—is digestible.

Vegetables are, as a class, inclined to produce flatulence, and those allowed should be taken very temperately. Of the pea group, very young and tender green peas and French beans may be taken. Of the cabbage tribe, broccoli, cauliflower, spinach, and Brussels sprouts will be the best. Of the salad group, celery, endive, lettuce; all thoroughly well boiled. Further, asparagus (very young) and seakale, both well boiled. Vegetables may with advantage be given as purees.

The root-vegetables and fruit-vegetables are not suitable.

In bad cases of dyspepsia the whole class of vegetables should be avoided.

Fresh fruits are scarcely to be allowed; grapes form, perhaps, an exception.

Fruits stewed are more digestible—e. g., apples, pears. The roast apple is excellent.

The use of this class is thus very restricted.

Milk is, in general, suitable, but it often requires some modification—e. g., by boiling, by the addition of isinglass, arrowroot, etc. (see First Part); milk as junket may be tried.

Fats in general are not well borne; and cooked, they are specially obnoxious. Frying is therefore never to be allowed, unless all the browned and fat outside parts are carefully removed before eating.

Butter may be taken in small quantity, but not cream.

Cheese is indigestible.

Eggs may be tried. They should be lightly boiled, by preference, but may be also tried beaten-up in the raw state.

Fish (the white-fibered) are allowable; in particular, whiting, sole, flounder, haddock, plaice, brill. The fish should be boiled.

Oysters may be tried. They must not be cooked.

The claw of the lobster is reckoned by some to be digestible; it may be tried. (The fibers of this part are very short.)

Birds (the white-fleshed poultry) are allowed; also game.

Poultry should be boiled or roast; game roast, with free basting.

Of butcher's meat, mutton is the best; but beef (especially as tender rump-steak) will generally prove both acceptable and digestible. Mutton boiled or roast, or, as chop, grilled, also steak, grilled. Tripe and sweetbread will be found to digest. They must be plainly dressed.

Soups (if allowed) should be clear, and taken **in small quantity.** They should not contain vegetables, though they may contain vegetable flavoring.

Plain dressing and thorough cooking holds all round for every class of food. Highly-spiced foods are quite unsuitable, but a moderate use of condiments is not forbidden.

As to beverages: some plead specially for tea, particularly if taken weak and brewed for a very short time. In most cases this will be found to be special pleading, and the forbidding of tea and coffee is necessary. Cocoa (the thinner forms, or best, the cocoa nibs) may do as a substitute. Of milk we have already spoken. It is a food as well as a drink.

The quantity taken should not exceed a breakfast-cup at a meal, and a teacupful will be preferable.

Plain water, cold or hot, or qualified with a little good whisky (if ordered), will be the best drink at the mid-day and evening meals. Half to three parts of a tumbler should be the limit. Wines and beers do not suit, especially the latter; nor do lemonades and drinks of this class.

It will be found in general that curtailing the amount of liquid of all kinds is beneficial.

A great many dietaries have been written out for dyspepsia, and some of these are very contradictory; but a diet such as we have sketched out will in the majority of cases give very good results. In some cases limitation of the diet to meats, almost entirely, gives the best results. We shall now proceed to illustrate this diet by actual dishes, but before doing so, just one remark may be permitted. Dyspepsia, though causing extreme discomfort, is not a disease with any fatal tendency: its victims may live long lives, but the usefulness of the lives led and the pleasure in life are decidedly much diminished. The dyspeptic lacks energy and is a hypochondriac; and, withal, there is the epigastric accompaniment of discomfort, not to

say pain. The choice is before him, and with these issues well in view, he is perfectly free to choose the tempting dish—only let him not complain. A wise restraint of the appetite for a few days will not only strengthen the will-power by the good effects resulting, but will so improve the powers of digestion that the ordinary diet may be gradually returned to. Dyspeptics especially should read carefully the section on the Hygiene of Digestion—and obey carefully the directions there given.

DIETARY FOR DYSPEPSIA.

First Day.—*Breakfast:* One cup of thin cocoa or cocoa-nib infusion, or thinned milk arrowroot; toast with a very little butter; lightly-boiled egg; baked apple. *Luncheon:* A tender rump steak, grilled, or beef or mutton collops, plainly dressed; milky rice; biscuit or stale bread. *Dinner:* Boiled sole on toast; mutton chop, grilled, or a slice from a joint, with stale bread; boiled celery; Devonshire junket; one or two tablespoonfuls of whisky in half a tumbler of plain water may assist at luncheon and dinner.

Second Day.—*Breakfast:* Cocoa as above, or thinned milk arrowroot; flaked haddock; toast or gluten bread; a baked pear (if too sweet, substitute a baked apple). *Luncheon:* Mutton cutlets; one roast potato (in jacket) or stale bread; cup custard. *Dinner:* Clear soup; roast partridge or roast pigeon; French beans or asparagus; lemon jelly; plain water biscuit or rusks, with a little butter.

BILIOUSNESS.

This is a popular but very vague term. It is variously applied: 1. To the **temperament**, but temperament is no longer recognized; 2, to the complexion, as more or less sallow; 3, to vomiting and diarrhea, with bile in the stomach; and 4, to a condition in which there is loss of appetite, nausea (and generally vomiting), headache, furred tongue, and constipation.

It is this last which we here deal with—the "bilious attack," in which, however, the part played by the liver and bile is not understood. It is usually due to acute **dyspepsia**, brought on by errors in diet; sometimes it is nervous in origin, being oftenest due to **eye-strain.**

The dietetic treatment for this bilious attack is negative—viz., by **abstinence** or by the taking of the **very lightest forms of diet**—such as milk and soda-water, water or milk arrowroot, or such like. There is no **menu** for the attack.

To prevent the occurrence of the attack, we observe the general rules already laid down for dyspeptics, and especially as regards the use of fat and rich dishes, and of pastry in every form; sugar also,

and sweet foods, must be taken in great moderation, or abstained from altogether. Thus there is nothing fresh to be said on the subject of prevention. The avoidance of the list of the other dietetic errors already mentioned will, of course, hold. It must not be forgotten, however, that many subjects of bilious attacks do not seem to suffer otherwise from dyspepsia in the intervals. These should not live richly, it is true, but they need not be over-strict, for in them it may be that the "attack" is simply the manifestation of a nerve-storm, the causes for which are outside the alimentary tract.

A good optician should be consulted. "Sick headache" is usually due to the need of glasses to correct "astigmatism" or other eye defects causing eye-strain.

Note on Gallstones.—A patient who is the subject of gallstones may, subsequently to an attack, and in the hope of avoiding further attacks, adopt certain measures, hygienic and dietetic. These have been summarized for us by a master of the healing art as follows: "He (the patient) must rise early, and take plenty of exercise in the open air, sleep in an airy bedroom, live sparely, drink little or no wine, and avoid all rich, fatty, and sugary food and malt liquors."

"TORPID" OR "SLUGGISH" LIVER.

These also are vague terms; but they mean something, and the liver is accused because, in addition to the usual symptoms (dyspeptic —referred to the pit of the stomach or under the heart), the region of the liver, just above and below the right margin of the ribs, is now the seat of discomfort—fulness, weight, aching. Pain in these cases is often referred to the right shoulder-blade or to the right shoulder. The complexion may be more or less sallow, and the whites of the eyes appear tarnished—yellowish. There will probably be constipation. These are the principal symptoms.

The real nature of the symptoms at work here is by no means clear, and there is not lacking evidence to show that a certain relation exists between this group of symptoms and the group of affections already spoken of under the headings Gout, Gravel, Stone (uric acid).

Leaving the matter to the physician to solve, what we do know more definitely is that excessive eating and drinking may cause the symptoms of "torpid" liver, and that certain articles of diet are specially noxious. Such are: Fatty and sugary or sweet matters, and all forms of pastry; also all malt liquors, particularly the stronger or fuller kinds; the fuller-bodied wines: port, sherry, Madeira; sweetened spirits, and liqueurs. A highly animalized diet will not suit

these cases, and any meat taken must be of the lighter kinds, and the dressing must be very plain.

This will apply to the routine diet of life, but during the actual persistence of the symptoms enumerated above, it would probably be best also to withdraw butcher's meat wholly from the dietary, for the time being. We thus note that the dietetic treatment will partake of the treatment of the dyspeptic and of the gouty, and, judging by the treatment, we are justified in regarding the "torpid" or "sluggish" liver as a symptom of the gouty-dyspeptic.

VOMITING.

The treatment of vomiting will certainly be in the hands of the medical man, and pending his arrival we shall either give no food or food in its simplest forms—e. g., a little iced milk, milk and soda, thin arrowroot made with water or milk, barley-water, etc. A teaspoonful of brandy added may sometimes help to stay the stomach.

Vomiting is often nature's way of curing. It is the means by which offending, poisonous or indigestible substances are most quickly gotten out of the stomach. By it also the stomach is rid of food which it cannot digest, either because overloaded or because of some interference with digestion. In such cases it is well to give a quantity of tepid water to drink, so that the stomach will be well washed out.

DIARRHEA.

The treatment of this affection also will be mostly outside our limits, but for passing disturbances of this kind a few simple dietetic observances may suffice.

The diet must be reduced to its simplest terms: Milk (preferably boiled) and milk foods, such as arrowroot, corn-flour, gruel, etc. Milk puddings—sago, rice, tapioca—are very suitable. Egg, beaten up or lightly boiled, may be taken. The addition of some spice, such as cinnamon or clove, is generally found grateful, and also the addition of a small quantity of brandy.

Food should not be taken hot, but either slightly warm or (if preferred) of the normal atmospheric temperature. There is no call to ice the food, as has been advised, unless the stomach is also very irritable.

Should the patient fancy it, a little meat jelly or meat juice, or even a little beef tea or mutton broth, thickened with sago, or rice, or tapioca, might be tried.

The idea prevails that meat broths do not suit in diarrhea cases, but some attacks, especially in children, are best treated exclusively on meat juices.

Meat broth, if allowed, should be taken cool or slightly warmed.

As the attack passes off there is a gradual return, by tentative steps, to ordinary diet.

Foods containing indigestible parts, such as the seeds of berries, the skin of fruits, fibrous white fascia or tough part of meats, hulls of oats or wheat, should either be avoided or these irritating, indigestible parts carefully rejected. Fats are also to be avoided.

CONSTIPATION.

This—a very common and habitual trouble—may sometimes be successfully combated by dietetic means alone. In every case we should first try such means before having recourse to medicine. We may state very briefly the needful observances:

(a) Fresh fruit and vegetables should be introduced liberally into the diet. Ripe fruit (apple, pear, orange) is best taken before breakfast—the first thing in the morning. Stewed figs and stewed prunes may be tried in their stead, if necessary. Ripe or stewed fruits may also accompany the luncheon and dinner. Fresh vegetables may be taken as salads, but there is more scope for the use of cooked vegetables—in particular, green vegetables. The Spanish onion (boiled) appears to be of special value.

(b) A coarse whole-meal bread should replace the finer white breads, and a plate of coarse oat or wheat meal porridge may be taken daily. This will, of course, come into the breakfast meal.

(c) Oils and fats appear to act beneficially; and hence, cream, butter, salad oil may be liberally partaken of.

(d) Milk and eggs are held to constipate: they do so less in the uncooked state.

(e) Rice, sago, tapioca, and some other farinacea are also held to constipate.

(f) Tea may be replaced by coffee or cocoa, both of which are comparatively free from astringency. Simple hot water, with cream and sugar to taste, is an excellent substitute for tea and may be all that is needed to effect a cure. It soon becomes well liked in preference to tea.

For the rest, ordinary food may be eaten without let or hindrance.

Unfortunately, constipation is too often associated with dyspepsia of some form or other, and then we may be unable to try the above-

mentioned articles of food. The limitations of such dyspepsia will be the same as those already set forth.

As in the case of dyspepsia, so in the case of constipation: we must make sure that no errors of living are being committed—**e. g.,** want of exercise, of routine attention to the action of the bowels, etc. If present, we must first correct these.

DIETARY FOR CONSTIPATION.

Ripe fresh fruit or a tumbler of cold water taken regularly the first thing on rising in the morning. If fresh fruit is not available, an excellent substitute may be obtained by soaking a prune or a fig all night in a tablespoonful of best olive oil.

First Day.—*Breakfast:* Oatmeal porridge, coarse variety best; coffee or cocoa; bacon; brown bread and butter; tomato salad. *Luncheon:* Mutton collops and onion sauce; baked apple. *Dinner:* Celery soup; marengo of chicken; potatoes; mixed salad, with salad-oil dressing, freely; water toast with compôte of apples.

Second Day.—*Breakfast:* Porridge, or hot oatmeal muffins; cocoa or coffee; sardines preserved in oil; tomato sandwiches. *Luncheon:* Raw oysters; brown bread and butter; baked pears. *Dinner:* Fried sole; braised mutton; boiled Spanish onion or other preferred vegetable; hydropathic pudding; celery, with cheese and biscuits.

BRIGHT'S DISEASE.

The treatment of this disease, in its acute form, should be wholly in the hands of the doctor. When, however, it has passed into a chronic condition, or when it has come on insidiously, without an acute stage, and the patient is up and about, the dietetic rules are very important, as the patient may thereby avoid many of the dangers which surround him.

Albuminuria (or albumen in the urine) is a constant symptom in Bright's disease and the kidneys are always more or less diseased and must be guarded against being overtaxed. Now a very important part of the work of the kidneys is the separation from the body of the waste products derived from the breaking up of albuminous, nitrogenous compounds; and hence, to lessen the in-take of foods rich in albumen has hitherto been made an essential feature of the dieting. Theory urges this upon us, and experience is supposed to have established the theory; and we see no reason at present to depart from the usual lines of treatment; but of late some doubts have been thrown upon the wisdom of the practice, and experiments have quite recently been brought forward to show that a full nitrogenous diet is beneficial, and not harmful. Under the circumstances, whilst advising that the usual dietetic precautions should be adopted, we

would urge that they should not be persisted in if the patient does not thrive, and that then a more liberal dietary might be tried. In any case, such a change should be under medical advice.

The following are the diets adopted in cases of Bright's disease:

(1) Milk only. The patient while adopting this should be under observation. The milk may be unmodified, and taken cold or warm, to the patient's taste; or it may be skimmed. In the latter case, constipation is more likely to arise. Four, five, or even six pints of milk may be taken in the twenty-four hours. The use of modified milk—e. g., whey and koumiss—has been advocated in place of milk.

(2) A modified milk diet, in which milk is still the basis of the regimen; but by various means—farinaceous thickenings and various flavorings—the monotony is relieved.

(3) A mixed dietary. This is the dietary most often adopted when the disease has become confirmed; and it is in the earlier stages of the trouble, or in stages halfway between the acute trouble and the established disease, that the stricter diets are more successful.

In the mixed dietary, the bread, rice, and potato group may be freely used, but the cooking must be thorough; and for this reason all pastries should be avoided. Milk puddings and bread puddings may replace pastry. Thoroughly cooked oatmeal or wheatmeal porridge may be allowed at breakfast.

Sugar in moderation is permissible, but sweets—e. g., jams, preserves—are best avoided.

The dried pulses are questionable: they are, of course, rich in nitrogen, but their chief disqualification is that they are difficult of digestion. The prepared meal (Revalenta Arabica) may be tried, and trial of even the unprepared bean meals may be made.

The entire group of green vegetables—the pea group, in the green and very young state, the salad group, also seakale, asparagus, the green and Jerusalem artichoke, the onion, marrow, tomato—all may be partaken of to the extent of their digestibility in each individual case.

Fresh ripe fruit is suitable.

Milk is good in any form: butter, cream. Cheese should not be taken.

Eggs are regarded by some as unsuitable, but may be tried.

Fish: the white kinds; the white-fleshed poultry; game. Of these the albuminuric patient may partake in moderation.

Of butcher's meat, if any be allowed, it will be mutton; but in

general the whole group will be avoided or partaken of very sparingly.

Fat bacon may be allowed, well toasted.

It will be seen, then, that the special characteristics of this dietary are the limitation of the solid albuminous foods, both as to quality and quantity, and the accentuation of the use of milk.

As to beverages other than milk: the use of tea and coffee will depend upon their toleration, and in certain cases where dyspepsia is prominent these will both have to be forbidden. Cocoa may then be substituted, and best, the cocoa from the nibs.

Alcohol in general is not well tolerated, and if allowed, should be taken as claret or hock; or a light beer may be tried. Water is best in the majority of cases. We would insist again that the effects of diet in the **individual case** must be most carefully watched, and in not a few cases the wisest physician will interfere least by diet or otherwise with the patient.

DIETARY FOR BRIGHT'S DISEASE.

First Day.—*Breakfast:* Porridge, with plenty of milk; cocoa; brown or white bread, or toast, with butter; baked slips. *Luncheon:* Tripe and onion sauce; tapioca cream, with stewed fruit. *Dinner:* Milk soup, calf's sweetbread, or roast pheasant; mashed potatoes; vegetable marrow; milky rice and baked apples (the pudding to be very milky).

Second Day.—*Breakfast:* Porridge with milk, or thickened milk; boiled fresh herrings, with dry toast; stewed fruit and cream. *Luncheon:* Filleted haddock, with brown bread and butter; apple snow. *Dinner:* Grilled chop, or roast chicken; bread sauce; duchess potatoes and salad; bread pudding with fruit sauce.

HEART DISEASE.

In a great variety of general affections the heart follows suit, indicating its sympathy by disturbed action. The dyspeptic, the obese, the gouty, the anæmic may all suffer from heart symptoms—such as breathlessness, palpitation, and the like. The treatment for this secondary affection of the heart is the treatment of the primary general disturbance; but in a considerable group of heart affections this organ is damaged mechanically, and the mechanical failure assumes the character of a primary disorder. The distinction should always be made between heart disease and heart failure. The heart may be diseased—**e. g.**, there may be some damage to a valve, involving more or less faulty action, but the faulty action may be more or less completely compensated for by adaptation: the powers of the heart to adapt itself are remarkable. Owing to defective valves the heart

is often called on to do a great deal of extra work. This causes it to develop increased size and power. On the other hand, the disease may have progressed to such an extent that adaptation fails. The fault is then no longer compensated for, and heart failure is established.

So long as there is no heart failure, we do not treat heart disease as such, either medically or dietetically, though we shall, of course, lay down such rules as shall maintain the general health at its best and spare the heart most; but the moment the heart fails it must be treated.

Heart failure invariably means a feeble circulation, with congestions or stagnations of blood. The alimentary tract, and in particular, its important appendage, the liver, suffer such congestions, and the process of digestion is more or less impaired. At times the digestive disturbance assumes the character of crises of acute dyspepsia: such are the gastric crises, so called.

It cannot be said that there is any specific dietetic treatment for heart failure. The food must be light and nutritious; but this statement means very little, and, in point of fact, we shall have to range from a purely milk or slop diet during a gastric upset, up through the milk and farinaceous diet, the fish and poultry diet, to the full diet, including a liberal allowance of butcher's meat. The dietetics of dyspepsia in general will be the dietetics of the impaired digestion of heart failure. We must therefore refer the reader back to the section on Dyspepsia.

Limiting the liquids is sometimes found very helpful—**e. g.**, one teacupful in place of two, and a teacup to replace the breakfast-cup; a half-tumbler at luncheon and dinner. The patient soon gets accustomed to the drier diet.

In cases of heart disease, dyspepsia, etc., a point is sometimes made of the time for the chief meal, the midday (1 to 1:30) being selected as the most suitable. This—other things being equal—is the best time, but much will depend upon previous habit and upon the exigencies of the day's routine, and it is not wise to lay down the law too rigorously.

BRONCHITIS.

Bronchitis is frequently a secondary trouble, and referable to a vice of system—**e. g.**, the gouty; or to disease elsewhere—**e. g.**, heart disease. Where this is demonstrable, the dietetic treatment must recognize the underlying vice or the diseased organ primarily at

fault. Where such is not demonstrable, it calls for little that can be regarded as special treatment. We may summarize very briefly the needful:

(1) In general, the patient needs supporting, and the diet should include the moderate use of cordials—preferably, a little good spirit (whisky or brandy); but a dry sherry or port (if there be no gouty tendencies) may be allowed, also an occasional glass of dry champagne.

(2) The midday is in most cases the best time for the chief meal. (See previous remarks.)

(3) The diet, though supporting, should be easy of digestion: Milk and milk foods; eggs, beaten up with milk or in the tea or coffee, with or without a small quantity of spirit; a small quantity of strong soup once or twice a day; white fish; poultry (white-fleshed); mutton; the more digestible vegetables, thoroughly cooked, etc.

(4) In some cases limitation of the fluids is found beneficial. Bearing in mind the principle of the diet—supporting and stimulant, but easy of digestion—we need not repeat at length the list of suitable foods, or plan out a special dietary. Reducing the amount of table salt in the diet is often helpful in heart disease, especially where there is œdema or swelling.

ASTHMA.

Here also we shall proceed much as in Bronchitis. The food should be light and nutritious. An asthmatic usually has a very sensitive stomach and an attack is easily brought on by bulky or indigestible food. The attack is most apt to come on at night. Therefore (1) select the diet as already directed under Dyspepsia, and (2) arrange to have the digestive processes completed or nearly so **before** going to bed; avoid late dinners or suppers. The midday meal should be the principal one and thereafter only very light food is allowable. This task of making the evening meal light is helped by making the breakfast substantial, but both this and dinner (or the midday meal) should be comparatively light—the diet in general should be "spare."

Cocoa may well replace tea and coffee as the beverage, though coffee is valuable during an attack of asthma.

Stimulants may be required, but are usually better let alone. If allowed, the best form is a small quantity of good spirits well diluted, taken as a digestive at mealtime.

Domestic Science

How to Prepare Food for the Family Table.

Subject Reference

See pages 319-348, Special Diets for Various Diseases.

See pages 391 to 403 for Broths, Soups, Gruels, Drinks, Jellies and Liquid Diets.

For Principles of Nutrition, see Vol. 2, pages 648-679.

Directions for Cooking.

Suggestions and Recipes.

TEA — The **preparation** has much to do with the excellence of tea. It should be made from water that was freshly drawn at the last moment before being put on the fire, and that is used the instant it has reached the boiling-point. Water that has boiled for awhile becomes flat, and therefore unfit for making tea. The flatness, however, may be removed by adding a dash of cold fresh water and bringing the kettle again to boiling. The kettle, too, that is used for boiling the water should be clean, both inside and out. When water is at all hard (and much of the water used in towns is more or less hard), the kettle quickly becomes furred inside; the outside also becomes covered with soot. The inside of a kettle should be washed out frequently with soda and hot water, and an oyster-shell which has been well scrubbed should be put into it. To this oyster-shell the fur will adhere, instead of clinging altogether to the bottom and sides of the kettle. The outside should be kept bright, because if soot is allowed to collect the kettle will be longer in boiling than it need be. Curiously enough, people who are most careful about the condition of the ordinary saucepans, will frequently leave the inside of the kettle untouched for months.

There is a great difference of opinion among tea-makers as to what kind of teapot is to be preferred for brewing tea. Many successful tea-makers decidedly prefer earthenware teapots. Others declare that good tea best yields its fragrance in a polished silver or metal teapot. The reason why good tea is so often made in silver teapots, is that their owners can usually afford to put plenty of tea in the pot. The advantage attached to earthenware teapots is that they can readily be made clean, and can easily be kept clean. It is believed, however, that if an earthenware teapot is in thoroughly good condition, better tea can be made therein than in a metal pot, because earthenware keeps hot longer than metal.

Because the soluble properties of tea are best extracted by soft water, and because in towns water is often somewhat hard, many make a practice of putting a pinch of bicarbonate of soda into the teapot with the tea-leaves. Only under very exceptional circumstances is this method to be recommended. Soda draws out the strength of tea, but it destroys its flavor, and it favors the extraction of the harmful principle in tea.

The length of time which tea should be allowed to draw varies with the quality of the tea; therefore, no rule for universal application can be laid down. Coarse tea yields its fragrance and strength more quickly than fine tea; and young leaves need to draw longer than old ones. Tea is never good, however, when it is allowed to draw longer than is necessary. Tea that is very strong and slightly bitter with long standing is most injurious. That the first cup will cure a headache while the second one will often cause a headache is because the second cup has drawn so much longer.

The following is the method recommended for **making tea.** Half fill the teapot with hot water, let it stand a minute or two until the pot itself is hot, then empty it. Put into it the requisite quantity of good tea (the old rule of a level teaspoonful for each person and one for the pot is an excellent one), and pour on gently enough freshly boiling water to half fill the teapot. Let it stand **two or three** minutes with the tea cosy over it; then fill the teapot and pour out the tea. When sugar and milk are used, they should be put into the teacup **before** the tea. Some people like lemon-juice in tea instead of milk. Lemon-juice should be put into the cup **after** the tea.

A tea cosy is valuable because it prevents the escape of heat from the teapot, and tea yields its goodness best when hot. If, however, a cosy is employed to keep the teapot hot for a long time the tea should be poured off the leaves into another pot that has been heated with boiling water and then emptied. Yet to dispense with a cosy is to dispense with one of the products of civilization. When it is necessary to make fresh tea, fresh leaves should on no account be added to those already in the teapot. The vessel should be emptied entirely and be rinsed with boiling water; then the tea should be altogether re-made.

As in Diabetes, so also in Obesity, saccharine may be used to sweeten tea or coffee.

Tomato and Egg on Dry Toast.—Wipe two ripe tomatoes, and cut them into small pieces. Mince very finely a thin slice of onion about the size of a thumbnail, also two ounces of lean ham. Melt a piece of butter, the size of a marble, in a small stewpan, and add two tablespoonfuls of broth; put in the minced mixture, and cook gently for about ten minutes. Lift the pan from the fire and add two well-beaten eggs. Stir quickly until the preparation begins to thicken; then take the pan off the fire again and stir until the eggs look lumpy and set without being at all hard. Pour the egg upon dry toast, cut into neat squares, and serve hot. It is necessary to remember that in cases of obesity the use of butter and fat must be limited.

Toast.—Bread used for toasting should be not less and not more than two days old; it should be about the third of an inch thick, so that it can be made crisp throughout. When it is so thick that there is a raw bread interval between the toasted sides, the raw piece is less digestible than the bread from which it was made.

In obesity, however, it is specially necessary that toast should be **thin.**

To make toast put the bread on the fork and hold it at a little distance in front of a clear, bright fire. When it is hot and dry on the surface, without having taken any color, turn it, and slowly bring the other side to the same condition. Now turn it again, and let it slowly become richly brown on both sides all over without being in the least black. Serve it at once. The art of making toast well consists in drying it slowly, browning it equally without burning it, and serving it as soon as done.

If toast is to be buttered, the butter should be spread lightly with the edge of the knife. To press butter into toast makes it heavy and spoils it.

Dry Toast.—Toast is very easily digested, therefore it is very often given in illness. It should be served as soon as it is made, if possible. When this is not practicable, pile the slices on a dish, cover with a napkin, and put the dish on the hearth or in the oven.

Any form of gluten bread (which see) is suitable for obesity.

Salad.—The secret of making a salad successfully from the various vegetables available for the purpose is to have the raw vegetable freshly gathered, in full season, and to make it thoroughly dry, and not to mix until a few minutes before it is served. A mixed salad that is allowed to stand loses its crispness, and the leaves become sodden. The easiest way of making a salad dry is to wash the vegetable quickly, drain it between the fingers, then lay it in the middle of a dry napkin, and toss it about lightly for a few minutes. Lettuce leaves for salad should be broken with the fingers; a knife should not be allowed to touch them. For the present purpose only salt and vinegar should be used as a dressing. In ordinary cases salt, good olive oil, and vinegar should be used, and many authorities are of opinion that whatever is added to these ingredients is injurious. The proportions then employed should be three tablespoonfuls of oil to one of vinegar.

Filleted Sole with Piquante Sauce.—Wash and dry a sole, skin it, and cut off the head, tail and fins. Cut the fish down the center and slip the knife underneath the flesh close to the bones, raise the flesh, and gradually draw it away from the bone. By this means four strips or fillets will be obtained from one sole. Smooth the fillets with a knife. Double them in two, with the shiny surface inside, salt them, and let them lie for an hour covered with vinegar. Lay them in a stewpan, and sprinkle salt and pepper over them, add a few drops of lemon-juice, and cover them with hot stock, or water if stock is not available; but in this case a few peppercorns should be added. Bring the stock to the boil, draw the pan back, and simmer gently for six or seven minutes—a minute or two more or less, according to the thickness of the fillets. Drain the fillets, arrange them prettily on a hot dish, have ready some brown Piquante sauce, and serve.

Brown Piquante Sauce.—Melt a tiny piece of butter in a small stewpan, and allow it to become brown without being at all burnt. Put with it half a gill of vinegar which has been boiled quickly to reduce it. Mix well, add pepper and salt, and pour over the fish through a strainer.

Fillet of Beef Sauté.—Take slices from the undercut of the sirloin of beef, a third of an inch thick. Trim away the skin and unsightly edges, and make the cutlets look very neat; flatten with a wet knife, sprinkle pepper and salt over them, and let them lie for an hour. Melt a small piece of butter in an omelet-pan over a gentle fire, put in the fillets, and let them cook for thirty or forty seconds, turn and cook the other side, and repeat until done. Dish in a circle. To make the dish look inviting, a slice of tomato the size of a shilling can be laid on each fillet, and chopped parsley sprinkled on the top. Or a few olives may be stoned, stewed in stock for about twenty minutes, and piled in the center of the fillets.

The fillet of beef may be obtained from the undercut of the sirloin or the undercut of the rump. The undercut of the sirloin is rarely sold apart from the sirloin, and few housewives care to cut it from the joint. The undercut of the rump, however, can generally be procured; but where it is not available, a slice of rump-steak may be used instead. It will not be as tender as the fillet, but it

will be more tasty. The gravy which flows from the fillets will be the most suitable accompaniment for this dish.

Cauliflower in Sprigs.—Trim a cauliflower; let it lie in salted water for an hour; look it over carefully; then put it into cold salted water and bring the water to the boil. At once throw the water away and plunge the cauliflower into plenty of fast boiling salted water. Boil gently till tender, but not soft. Break the cauliflower into branches, and serve.

Fried Celery.—Cut some celery iuto pieces of a uniform size, throw them iuto boiling water to which half a cupful of vinegar and a little salt have been added, and let them boil gently for ten miuutes. Take them up, drain them, lay them in cold water, and dry. Mix a teacupful of fine, dry bread-crumbs with a tablespoonful of grated Parmesau, and a little pepper and salt. Roll the celery in flour, brush it all over with beaten egg, and toss it into the bread-crumbs. Place a few sticks at a time in a frying basket, plunge into boiling fat, and when crisp drain on kitchen paper, and pile crosswise on a dish. Serve hot.

Baked Apple and Rusks.—Choose apples in perfect condition; wash well and prick the skin with a daruing needle. Then put them into a deep dish, add a few spoonfuls of water, and bake very gently indeed. Serve with dry rusks. The apple may be eateu hot or cold.

Coffee.—With good material and proper appliances it is exceedingly easy to make good coffee; therefore we can only wonder that it is such a rarity. The materials required are a sufficient quantity of freshly roasted and freshly ground coffee-berries, fast boiling water, and a **cafétière** such as is sold by every ironmouger. No chicory is needed; indeed, if pure coffee is desired, the employment of chicory must be forbidden. Chicory gives color and brilliancy to the beverage into which it is introduced, and some persons think it produces a palatable drink. But the drink produced is **not coffee.**

The **fragrance** of coffee escapes from the berry very quickly, and it is necessary, therefore, that the coffee should be freshly roasted. The most effectual way of securing this condition is, of course, to have it roasted at home, and small coffee roasters are to be bought for a moderate sum. Not many housekeepers, however, care to undertake this business; and where large shops are within reach, it is not imperative that they should do so. At large establishments coffee is always roasted frequently, and if a small quantity is bought at one time, if the coffee is stored in a canister with a tightly fitting lid, and if the berries are gently **heated in the oven** before beiug ground, to revive the flavor, the coffee will be everything that could be wished. It is indispensable, however, that the berries **should not be ground until they are wanted.** Coffee made from powder that has been ground even for a few hours is sure to be more or less stale and unprofitable. To use the cafétière, first fill it with boiling water, let it stand a minute, then pour the liquid away. Place the requisite amount of coffee upon the perforated bottom of the upper compartment, put the strainer in its place, and pour in gently and gradually as much boiling water as is needed. Cover the cafétière, and leave it in a hot place until the water has filtered from the upper compartment into the lower one. If it is to be served in another pot, the vessel which is to receive it must be made hot with boiling water before the coffee is poured in it.

The quality of coffee depends very much upon the quantity of material used. It is obvious that though coffee may be well made, it cannot be strong unless we use plenty of coffee. Ideas differ very much, however, as to the degree of strength

which is desirable. Thrifty housewives who consider coffee injurious declare that a teaspoonful of ground coffee is sufficient for half a pint of water. The usual allowance, however, is a heaped tablespoonful of coffee to half a pint of water. Very black coffee is sometimes made with a heaped tablespoonful of coffee to a quarter of a pint of water; and the Turks, we are told, use three tablespoonfuls of coffee to each small cup. When, however, it is wished that the coffee should be very strong, it is better to decrease the measure of water rather than to largely increase the quantity of coffee used. If too much coffee is placed in a cafétière the water does not filter through thoroughly. Moreover, no one can drink a large quantity of very strong coffee. One way of securing a supply of strong coffee is to preserve a small quantity of the beverage, should any be left, from one day to another, and make coffee for the second day from a weak solution of coffee and water, instead of plain water. We learn that the garçons in the French cafés always do this when they can. The cold coffee should not, however, be left standing in the cafétière; it should be drained off and kept in a glass bottle closely stoppered.

When milk is used with coffee, it should be scalded, not boiled; and many think it an improvement to put the milk in the cup before the coffee. When coffee is very strong the proportions used are one-half coffee and half milk.

When coffee is not good the reason usually is either that it has not been made in a proper coffee-pot, or that a sufficient quantity of coffee has not been allowed, or that the coffee-pot was not clean. A vessel of this description requires most careful attention, and it very soon gets out of order if it is neglected. It is not enough to rinse the cafétière out every day after use. There is an oily property about coffee which adheres in spite of rinsing out, and which clogs the holes of the filter, and not only keeps the coffee from running through, but also injures its flavor. A coffee-pot should be **daily washed**, not rinsed, **with boiling water**, and the pieces should be taken apart and dried separately. If packed away wet, and left to dry by themselves, they will in time impart a metallic taste to the liquid. Cold water is worse than useless for washing a coffee-pot, because it sets the oil.

When a cafétière is not available, respectable, though decidedly inferior, coffee can be made in an ordinary coffee-kettle, in the pot in which it is to be sent to table, or even in a jug. The following methods are, in these cases, recommended:

To make Coffee in an ordinary Coffee-kettle.—Measure the quantity of coffee to be used. Make it hot in the oven to revive the flavor; then put it into the kettle, and pour the boiling water slowly over it. Let it stand a minute or two; put it on the fire, and bring it gently to the point of boiling. Take it off the fire, pour out a cupful of the infusion, and return it to the pot from a good height. Repeat this operation twice. Throw a tablespoonful of cold water into the coffee, let the pot stand by the fireside for three or four minutes, strain the liquid through muslin into the heated vessel from which it is to be served, and send it at once to table.

To make Coffee in the Pot in which it is to be sent to table.—Make a small bag of unbleached calico to be used as a strainer, and fix it so that it shall be suspended in the middle of the coffee-pot. Allow an ounce of coffee for each quart of the beverage. Heat the ground coffee, put it into the bag, and pour over freshly boiling water to cover the bag entirely. Let the pot stand in a warm place for ten minutes, and serve.

To make Coffee in a Jug.—Fill the jug with boiling water, let it stand a minute or two, then empty it. For a pint of coffee put two tablespoonfuls of ground coffee into the jug, pour water, which should be freshly boiled and actually boiling, over it, and stir with a spoon. Cover with a cloth pressed into the top, and set the jug on the hot plate for five minutes. Have the vessel in which the coffee is to be served made hot, lay a piece of muslin over it, and pour the coffee gently through the muslin.

When coffee is made with any other vessel than a cafétière, the employment of chicory may be preferred. The proportions usually taken are from three to four ounces of chicory to one pound of coffee. Too much chicory makes coffee undrinkable.

Fillets of Haddock.—When the haddock comes into the house the day before it is to be used, clean it, cut off the head, remove the skin, rub it over with salt and hang it in a cool place. When it is to be cooked, divide the flesh into fillets about an inch and a half square; put them in a stewpan containing as much boiling salted water as will cover them, and let them simmer three or four minutes till done. Drain the fish, arrange it neatly on a hot dish, squeeze the juice of a lemon on it, and sprinkle chopped parsley over it. Set in the oven for a minute or two till quite hot, and serve.

Dried haddock is very tasty cooked in the same way. It would need, however, to be placed in cold, not boiling, water, and would be done when brought to the point of boiling. It would not require any salt.

Oysters.—To be enjoyed in perfection, oysters must be alive when opened; also they must be **freshly opened,** for they deteriorate in flavor and excellence every minute that they remain on the shell. Many varieties of oysters are now sold, and their price varies very much. Natives are, of course, the best, and next in value come the oysters known technically as "seconds," and which are almost equal to natives. The large, white, fat oysters are most suitable for sauce.

Oysters are usually eaten with pepper and vinegar, with a slice of thin brown bread and butter. Epicures in oysters, however, frequently prefer them without anything. They can also be bearded or not, according to taste. They are generally considered more dainty when neatly bearded.

Omelette Soufflé.—This dish can be made with the greatest ease when a hot oven is available. The only point requiring attention is that the eggs should be beaten properly. The yolks and whites should be beaten separately. The yolks should be beaten with the requisite amount of sugar and a little flavoring until they become very thick and cease to froth. **In cases of obesity the less sugar used the better.** The whites should be whisked until they are quite firm and solid, and can be cut clean through with a knife; they may then be mixed lightly with the yolks. The preparation can then be put in a warmed and buttered earthenware or china dish, or into a small enameled omelette pan, and set in a quick oven. In from five to ten minutes (according to the number of eggs used) it will be fit for serving. It should have risen well and be set. It should be served without a moment's delay, as it will fall very quickly when it is once removed from the oven. It will be all the better if it can be served on the dish on which it was cooked. The dish will need to be greased sufficiently to keep the preparation from sticking to it, no more. **Butter is not an essential ingredient of an omelette cooked thus.**

Fried Chicken with Chives.—A young fowl only is suitable for this dish. It

should be divided into four or six parts, or the legs only can be cooked thus, and the remainder of the bird prepared in some other way. Chives are less used in cookery than they deserve to be, because they have in abundance the good qualities of the onion, and its bad qualities, the unpleasant odor and strong taste, in a less degree. They are very hardy and easily grown where there is a garden. The bulbs are slender, and not worth using; the leaves and young tops of the plants are, however, very delicate, and impart a piquant flavor to the dish with which they are served. To prepare them, wash them, then cut them into thin rings, throw them into a basin containing boiling water, and let them soak for three or four minutes. Take them up, dry them perfectly by spreading them between the folds of a napkin. If chives are not available, a thin slice of shallot chopped till as fine as sawdust may be used instead.

To prepare the chicken, truss it, or cut it into joints, and dry it well. Put in a shallow stewpan or fryingpan about three ounces of butter, or half butter and half oil may be used. When it fizzes put in first the legs of the fowl facing each other, the wings on each side, and the rest of the bird in the middle. Add salt and pepper, and fry over a good but not fierce fire. If the fowl cooks softly it will be sodden; if it is fried too quickly it will be burnt outside without being cooked inside. It must be kept at a moderate heat and turned frequently, and the pan should be shaken to keep the butter from burning. The legs of the fowl should be taken out last. The fowl should be done in from fifteen to twenty minutes. If the fat were boiling when the joints were put into it, the dish would not be greasy at all; it would simply be browned quickly on the outside, and the gravy would be kept inside.

When the fowl is sufficiently cooked, take it up, put the joints between two plates in the oven, throw the chives or the minced shallot into the frying-pan, and let them cook in the hot fat until yellow, not brown. Drain, scatter over the fowl, and serve.

If sauce is desired for this dish (although it will be very good without), it may be prepared as follows: Drain the fat from the frying-pan and pour into it a cupful of stock (or a glass of white wine if approved). Put with it half a teaspoonful of Liebig and a few drops of lemon-juice; pepper and salt. Arrange the pieces of chicken in a pyramid form—the inferior portions at the base, the delicate parts on the top.

When cooking a fowl thus, it is most necessary to keep turning the joints to avoid burning. Avoid, however, sticking the fork into the flesh, as the gravy will then escape.

Asparagus.—Asparagus is always enjoyed as a separate course. Scrape the stems slightly, and throw them at once into cold water. Cut the white ends evenly to make the stalks the same length, and tie them with twine in bundles of an equal size. Use a stewpan large enough to hold the asparagus without bending the stalks. Half fill it with water, salt it; when it boils skim it, and put in the asparagus. Leave the lid off the pan, and boil gently till tender. It will need to boil from twenty to thirty minutes, according to thickness, but should be taken up as soon as done, or it will lose color and flavor. Drain well, and serve on toast.

Raspberry Jelly.—Simmer about a breakfast cupful of ripe raspberries, mixed with a few picked red currants, with half a cupful of water until the juice flows freely. Turn the fruit upon a sieve, and let the juice drip from it without pressure. Soak a tablespoonful of gelatine in water enough to cover it. When the

water is absorbed, dissolve the gelatine in the fruit juice. When the jelly begins to thicken, put it into small moulds or glasses. **If sweetness is required, use saccharine instead of sugar.** The employment of sugar is to be avoided in cases of obesity.

Mutton Chop.—Take a chop from the middle of the loin of mutton, trim it neatly, and pepper and salt it. Use for cooking either a hanging gridiron or one that is intended for the top of the fire (the latter is to be preferred), and be sure that it is perfectly clean. Grease the bars, and make them hot; put the chop in its place, and be sure not to stick a fork into the lean part when moving it. To do so would let the gravy escape; the meat should be taken hold of either with a pair of steak tongs or with a spoon and fork. As soon as one side is brown, turn the chop, let the other side brown, turn again, and repeat until the chop has been turned six times. The length of time required will depend upon thickness. A loin chop three-quarters of an inch thick lightly done will take about ten minutes; well done, about twelve minutes. It is done enough when it feels springy if pressed with a fork. Serve it on a hot dish, with pepper and salt, and a slice of butter laid on it if approved.

A chop is at its best when broiled, but it is not always convenient or possible to have the hot, clear fire needed for broiling in the morning. Should necessity compel, therefore, the chop may have to be sauté, or cooked in the frying-pan, instead of being broiled. In this case very little fat should be used, enough only to keep the chop from burning, and it should be already melted before the meat is put in. At the end of five minutes the chop should be turned, and cooked till done. A chop cooked in the frying-pan is, however, sure to be inferior to one that is broiled over the fire.

Diabetic Bread.—One of the greatest privations which have to be endured by diabetic patients is in respect of bread; and, therefore, many efforts have been made by scientific experts to supply an acceptable substitute for this food. Bread made from prepared gluten flour, bran flour and powdered almonds, has been produced, and can be bought in the form of slices and rolls. Gluten biscuits, bran biscuits and bran cakes, are also to be obtained, and they have been extensively used.

Gluten bread is never entirely free from starch, and, unless it is prepared with great care and by known manufacturers, it may even contain a considerable quantity. It is also by no means agreeable to the palate. Yet, when well and carefully prepared, it undoubtedly supplies a need.

Bran bread, made from bran washed as free from starch as possible, is also largely used for diabetics, but, unless very carefully prepared, it contains a considerable amount of starchy material, and also a large proportion of indigestible cellulose, which, with some persons, sets up a great deal of gastro-intestinal irritation.

Dr. Camplin's formula for making bran bread is one of the best. Dr. Camplin was for many years a diabetic, and he effectually succeeded in keeping his disease at bay. He spoke very strongly from personal experience in favor of bran food as a substitute for bread in diabetes. The following is his recipe:

"Take a sufficient quantity, say a quart, of wheat bran; boil it in two successive waters for a quarter of an hour, each time straining it through a sieve; then wash it well with cold water on the sieve until the water runs off perfectly clear; squeeze the bran in a cloth as dry as you can; then spread it thinly on a dish, and place it in a slow oven. If put in at night, let it remain in till morn-

ing, when, if perfectly dry and crisp, it will be fit for grinding. The bran thus prepared must be ground in a fine mill, and sifted through a wire sieve of such fineness as to require the use of a brush to pass it through; that which remains in the sieve must be ground again until it becomes quite soft and fine.

"Take of this bran powder three ozs. (some patients use four ozs.), the other ingredients as follows: three new-laid eggs, one and a half ozs. of butter (or two ozs. if desired) and about half a pint of milk. Mix the eggs with a little of the milk, and warm the butter with the other portion; then stir the whole well together, adding a little nutmeg and ginger, or any other agreeable spice. Bake in small tins (patty pans), which must be well buttered, in a rather quick oven for about half an hour. The cakes when baked should be a little thicker than a Captain's biscuit. They may be eaten with meat or cheese at breakfast, dinner or supper; at tea they require a rather free allowance of butter, or they may be eaten with curd, or any of the soft cheeses."

It is important that the above directions as to washing and drying the bran should be exactly followed, in order that the bran may be freed from starch and rendered more friable. Bran in its common state is soft, and not easily reducible to fine powder. In some seasons of the year, or if the cake has not been well prepared, it changes more rapidly than is convenient. This may be prevented by placing the cake before the fire for five or ten minutes every day. The use of seven eggs instead of three is an improvement, also the addition of a teaspoonful of carbonate of soda.

Another authority advocates bread made from bran flour instead of ordinary bread for diabetics. It should be made at home. The following recipe is by a lady, the wife of a diabetic, who contributed much to her husband's comfort by devising various palatable substances for his use.

Recipe for Bran Cakes.—Take four ozs. of prepared bran flour, two ozs. of butter, one drachm of bicarbonate of soda, five eggs and about a quarter of a pint of warm milk. First mix the bicarbonate of soda with the bran flour; then beat up two ozs. of butter in a hot basin, and shake into it the mixture of bran flour and bicarbonate of soda, beating with a spoon all the while. Next beat up the five eggs in a separate basin before the fire till milk-warm, and stir them gradually into the mixture of bran flour, soda and butter. Beat up all well together for at least ten minutes, adding gradually the warm milk. Place in well-buttered tins, or patty pans, and bake in a brisk oven for about ten minutes. The cakes are done when they will turn out of the tin quite easily. The above quantities will make about five cakes of the size of ordinary buns. The cakes, if desired, may be cut into slices, toasted and buttered.

When the directions here given are properly carried out, a substitute for bread is yielded, which may, of course, be supplied to the patient every day, or as often as may be desired, and which is really not unpalatable. It ought to be light, soft and moist, without giving an impression of feeling wet or cold in the mouth.

Instead of all bran flour, equal parts or other proportions of bran and almond flour may be used. The cakes, in the opinion of many, are thus rendered more palatable. The almond flour seems to soften and neutralize the taste of the bran, while the bran reduces the richness of the almond flour.

After the process to which the bran is subjected in washing, it may be questioned if it possesses really any nutritive value; but as it is employed, it is combined with other materials, and plays the part of an unobjectionable agent which gives bulk to what is consumed and, therefore, supplies something for filling the

stomach, and enabling the patient to feel that he has taken a full meal. A certain **bulk** is essential to the proper digestion of a meal.

Pavy introduced almond cakes as a substitute for ordinary bread, and it is undoubtedly a valuable one. By washing the meal of sweet almonds with acidulated water the greater part of the sugar is removed, and the meal so treated may, by careful preparation, be made into a palatable cake or biscuit. Seegen also advocates the use of almond cakes, and gives the following recipe for making them:

Almond Cakes.—Take of blanched sweet almonds ¼ lb.; beat them as fine as possible in a stone mortar; remove the sugar contained in this meal by putting it in a linen bag, and steeping it for a quarter of an hour in boiling water acidulated with a dessertspoonful of vinegar; mix this paste thoroughly with three ozs. of butter and two eggs. Next add the yolks of three eggs and a little salt, and stir well for some time. Whip up the whites of these eggs and stir in. Put the dough thus obtained into greased moulds, and dry by a slow fire.

Of almond biscuits, Dr. Pavy says: "By many diabetics almond biscuit can be taken, and it is considered a desirable addition to the other kinds of food allowed, but it must be admitted that by some it is found to be too rich for ordinary consumption with the meals. It goes very well, however, with a little sherry or any other kind of wine alone, and composed as it is entirely of almond flour and eggs, it forms a highly nutritive and serviceable food. It is eaten well by children."

Vegetable Marrow with Savory Mince.—Cut a vegetable marrow into two lengthwise, and remove the seeds. Salt the pieces, and let the water drain from them. Have ready a stuffing made of equal parts of lean veal or beef and cooked bacon finely chopped, to which chopped parsley, pepper and salt may be added. (The possible saltness of the bacon must be remembered when the salt is put in.) Fill the two halves of the marrow with this, press them together, and bind them with tape. Lay the vegetable in a saucepan or deep dish, with a little butter, pepper and salt, a wineglassful of stock, and a few drops of lemon-juice. Simmer gently or bake till the marrow is quite tender. It will probably need to be cooked for a couple of hours. If preferred, partially cooked sausage-meat made without breadcrumbs may be used instead of the bacon force-meat. A more speedy method of preparing this dish is to fry the marrow in the first instance, then fill it with force-meat, and set it in the oven till hot through and brown on the top.

Savory Custard.—Whisk one whole egg and the white of an egg, and mix it either with a gill of stock or a gill of cream, whichever is preferred. Flavor with a pinch of salt and a little nutmeg; or the custard may be sweetened with saccharine, and flavored with a little almond. Pour it into a buttered gallipot (glazed earthen jar), cover it with a buttered paper, and place it in a saucepan of boiling water, with water coming half-way up the jar. Let it steam very gently until firm in the center. If more convenient, the custard may be poured into a small pie dish, put into it a dripping tin containing boiling water, and cooked in the oven.

Clear Soup with Poached Egg floating in it.—Poach an egg carefully and lightly, then trim the edges neatly. Place it in a hot soup plate, and pour a breakfast-cupful of clear soup gently over it. A little chopped parsley or chopped chervil may be sprinkled in at the last moment. (For Clear Soup, see index.)

Braised Partridge, with Cabbage.—This is an essentially French dish, and very

tasty. It is, however, not suitable for young partridges. When these can be obtained, there is no better way of dealing with them than to roast them.

When the bird is to be braised, truss it as a fowl is trussed for boiling, with its legs tucked inside. Put it into a stewpan with a slice of fat bacon cut into dice, and an onion with a clove in it, and turn it about till it is lightly browned all over; pour round it half a pint of strong, well-flavored stock, and add any bacon bones or meat trimmings that may be available. Cover the pan closely and simmer gently.

While the partridge is being cooked, the cabbage may be prepared. Procure a freshly-cut tender cabbage, or half a Savoy. Wash it well, drain it, cut out the stalk, and boil it with enough stock to cover it, and a slice of bacon or some bacon bones, pepper and salt. When quite tender, strain it, and cut it into slices: Take up the partridge, strain the gravy and reduce it by boiling it quickly. Also free it from fat. Place the bacon bones, etc., in the bottom of the stewpan, put a layer of cabbage upon this, then the partridge, then the rest of the cabbage, moisten with the gravy; cover closely, and stew gently for half an hour. The time needed for cooking this dish will depend on the age of the birds. If they are old, three hours will not be too long; if they have recently attained their full growth, an hour and a half altogether will be long enough.

To dish the partridges, make a bowl very hot, put the cabbage into it, place the partridges on this, and cover with cabbage. Remove the bones, trimmings, onion, etc., make the gravy very hot, and garnish the mould with the bacon. Turn the contents of the bowl upon a hot dish, and pour the gravy over all. Fried sausages are sometimes served with partridges thus dressed.

Kidneys and Mushrooms.—Skin and core two sheep's kidneys and cut them into small, neat pieces. Melt an ounce of butter in a saucepan, and throw in about two dozen champignons, or, if they can be had, the same quantity of fresh button mushrooms may be used, and half a gill of stock. Simmer gently (on no account boil) for seven or eight minutes, and stir well. Throw in the prepared kidneys, and again simmer gently till the kidneys are cooked. At the last moment add pepper and salt, and half a teaspoonful of chopped parsley: also, if approved, half a gill of sherry. Serve hot.

Baked Plaice.—Procure a thick plaice, and lift the fillets from the bone; wash and dry them, and put them in a single layer in a buttered baking tin; salt and pepper them, and sprinkle the juice of a lemon over them, and pour a tablespoonful of stock round them. Cover them with buttered paper, and bake in a gentle oven for about ten minutes. Serve on a hot dish, with their own gravy, flavored with essence of anchovy poured over them.

Veal Cutlets *à* la Talleyrand.—Take a slice of veal from the fillet, weighing about one pound, and an inch in thickness. Cut it into rounds half an inch thick and three inches across; flatten them with the side of a broad-bladed knife dipped in cold water, and carefully remove all skin and sinew, which would cause them to shrink when cooking. Have ready a shallot finely minced, four mushrooms chopped small, a tablespoonful of chopped parsley, a little lemon-juice; the yolks of two eggs, a quarter of a pint of stock; a gill of cream, a little butter, pepper and salt. Melt two ounces of butter in a scrupulously clean sauté pan, and cook the cutlets very gently without letting them brown. Season them with pepper and salt, sprinkle over them the chopped shallot, mushrooms and parsley, pour the stock over, and simmer for twenty minutes. Strain off the gravy and free it from fat. Dish the cutlets in a circle and keep them hot a minute. Put

with the gravy the yolks of two eggs, and stir over the fire for a few seconds to cook the eggs, without letting the sauce boil. Add last of all the cream and a few drops of lemon-juice; pour the sauce over the cutlets and serve.

Seakale.—Wash some seakale, and tie it in bundles. Put it into boiling salted water, and boil it gently for about twenty minutes, or till tender. Drain and serve.

Savory Jelly.—Soak an ounce of gelatine in cold water to cover it for half an hour. Put a pint and a half of second stock or water into a perfectly clean saucepan with the gelatine, a small piece of leek, one shallot, a piece of celery, a blade of mace, and either the strained juice of two lemons or a tablespoonful of vinegar, one gill of sherry and half a teaspoonful of salt, also the whites and cleaned shells of two eggs. Whisk the jelly till it rises in the pan, let it boil, draw the pan back and let it stand for twenty minutes; then pour it gently into a jelly bag, disturbing the scum, which will act as a filter, as little as possible. When clear, put it into small glasses, and for a nice flavor, drop one or two leaves of tarragon and chervil in to set with it.

Salted Almonds.—Take two ounces of sweet almonds, throw them into boiling water, and let them remain on the fire till the skin can be slipped off easily. Skin them, dry them in the oven. Heat a tablespoonful of oil or butter in the frying-pan, and fry the almonds in it till lightly browned. Drain and dust with fine salt, and toss the nuts until each one is savored. If preferred, the almonds can be served hot as soon as salted, or they may be set aside until quite cold. As a salted relish, eaten very sparingly, the small quantity of sugar present may be ignored.

Cocoa made from Nibs.—This beverage is quite unlike cocoa made from the soluble powder, and is much more valuable as an article of diet. It has rather a peculiar taste, to which, however, the palate soon becomes accustomed; when well made, it is clear and bright, like coffee. As it is necessary to let it simmer for some hours, it must be prepared betimes. In households where it is used regularly, a special saucepan is set apart for its preparation, and this is kept constantly simmering by the side of the stove.

Allow a teacupful of cocoa nibs for each quart of water. Crush the nibs to small pieces under the rolling-pin, soak them all night in the requisite quantity of cold water, and next day let them simmer gently in the same water for six or seven hours. As the water boils away, add a little more from time to time, to preserve the measure. When sufficiently boiled, strain the liquid; let it go cold, skim the fat from the top, and the cocoa is ready. From motives of economy, the old nibs are sometimes boiled with the fresh ones. This plan makes the cocoa strong, and it extracts the goodness thoroughly from the nibs, and thus prevents waste; but the beverage thus produced is less bright than it otherwise would be. Cocoa shells are sometimes substituted for cocoa nibs. The mode of preparation is the same.

Cocoa made from Prepared Powder.—There are many cocoa powders in the market, but most are not as suitable for invalids as cocoa made from nibs. When any special mode of preparation is recommended, directions for making are given with the package, and these should be followed. When no directions are given, the quantity of cocoa required should be mixed to a paste with cold water; boiling milk, or boiling milk and water, or boiling water should then be

poured in gradually with one hand, while the preparation should be stirred gently with the other.

Chocolate.—Carefully made chocolate is a very delicious drink, and though not suitable in the present case, when suited to the condition of the invalid it makes a pleasant change. It is sold in the form of squares or fingers. The following is the method of preparation. Put a small piece of chocolate (about half an ounce) into a saucepan with a cup of boiling water. Stir till the chocolate is dissolved; as soon as the water boils add a teacupful of milk and a lump of sugar. When the chocolate boils once more, serve immediately. Continued boiling will spoil it.

As the size of the shapes and the strength of chocolate of different makers varies, it is well to experiment with one sort until it is found how much chocolate is needed to make for a cup. Chocolate that is overstrong is indigestible and not agreeable to the taste.

Haddock, plainly Boiled.—Cleanse a moderate-sized haddock, remove its eyes, and truss it with its tail in its mouth. Put a few peppercorns, some salt, and a little vinegar into as much water as will cover the fish. Bring this to the boil, lower the fish into it, bring it again to the boiling point, and simmer till done. The time required will depend on the size and thickness of the fish.

Plain Rice Pudding, with Stewed Apricots or other Fresh Fruit.—Wash the rice in two or three waters. This will get rid of the loose starch, and will also do much to prevent burning. If a milky pudding is wanted, two tablespoonfuls of rice will be enough for a quart of milk. When a solid pudding is preferred, it is not unusual to allow nine times as much milk as there is rice. For gouty patients, however, the milky pudding is the better of the two.

A simple way of making the pudding is to put a pinch of salt and a little grated lemon rind with the rice after it has been washed, pour the milk over it, and bake it very slowly in a cool oven. So long as it cooks at all, the more slowly it is baked the more the grains will swell, and the more digestible the pudding will be. A piece of butter about the size of a ten-cent piece should be put with it, and it should not be stirred after it has once begun to bake. One way of ascertaining whether or not the rice is sufficiently cooked is to raise the dish at the side a little. If the rice and milk move together, the rice is cooked; but if the milk moves and the rice remains at the bottom, it is not.

Apricots, Peaches or Apples Stewed.—When stewing fruit, it is most important that a dainty saucepan should be used for the purpose. A vessel that has been used for meat or gravy, even though it has been thoroughly cleansed, is liable to convey an unpleasant flavor. Also the fruit should be **gently** stewed; if boiled hard it will break, and be comparatively worthless. When fruit is very acid, and when it is necessary, as in the present case, to be sparing in the use of sugar, a very small pinch of carbonate of soda may be put with the juices, and this will to some extent modify the acidity.

Mineral water or milk, with one or even two tablespoonfuls of whisky, may be allowed with the pudding and fruit.

Boiled Fillets of Whiting.—Whiting is exceedingly delicate fish, and very easy to digest. Fillet it by passing the knife from the tail to the head, close to the bone, and lifting the flesh from the bone on both sides. Divide each side into halves, trim the fillets into good shape, pepper and salt them, and boil them in salted water to which a few drops of lemon-juice have been added. Let them simmer gently for a few minutes till cooked through, but they must not be over-

cooked. Take up carefully with a slice or lifter, dish prettily and sprinkle chopped parsley on the top. Fish cooked according to this simple recipe will be excellent if it is served hot, and if everything about it is hot. If half cold it will not be worth eating.

Ptarmigan, Partridge or Grouse.—When these can be obtained of good quality, they are excellent. They vary very much, however, and therefore they need to be carefully chosen. Birds that have fed on young mountain firs have a taste of turpentine, and are worthless. Those that have fed on the open plains are much superior. A delicate scent will detect the "turpentine smell." The birds should be bought at a good shop.

Ptarmigan, Grouse or Partridge should be young and plump, and they should be well hung. They should be trussed like a fowl, roasted before the fire or baked in the oven, and basted as much as possible with hot fat. They will take from twenty-five to thirty minutes. When almost done a slice of toast should be put under them. Crumbs made from the crust of bread grated and used dry, or from the inside of a stale loaf, crumbled, passed through a sieve and dried in the oven, may be handed round with the game.

Broccoli.—For all practical purposes broccoli and cauliflower are the same vegetable, though epicures say that the cauliflower has the more delicate flavor of the two. An advantage which belongs to broccoli is that it is less likely to have caterpillars in it than the other. The secret of making it mellow is to cut the root right across, to put into fast-boiling water to cover it, and to put into the water with it whilst it is boiling a knob of butter and a little salt. When the flowers are soft it should be quickly and thoroughly strained. A little sauce may be poured over it in the dish.

Bird's-Nest Pudding.—Butter a pudding-dish, and put into it two tablespoonfuls of bullet sago well washed, a pinch of salt, the rind and juice of a lemon, and a slight sprinkling of sugar, the less the better. Fill the dish with warm water. Pare four or five good cooking apples, and remove the core without breaking the fruit. Bake till the apples are tender and the sago transparent, and serve with milk.

Bacon.—Rashers of bacon served at breakfast may be fried in a frying-pan, broiled, or toasted in a Dutch-oven, or with a toasting-fork, till the fat is quite clear. Of these three methods the last is the best, and the first is the worst. The rashers should be cut as thin as possible, and the rind should be trimmed away. When the employment of a frying-pan cannot be avoided, the cooking should be very slowly done, and the bacon should be turned occasionally. It is important that the pan used should be daintily cleaned, and not at all burnt or black. If a little butter or bacon-fat be made hot in the pan before the bacon is put in, the dish will be improved thereby. This plan is not usual, but it is to be recommended.

Baked Sole.—Skin the fish, lift the fillets from the bones, and trim them neatly. Grease a shallow tin sparingly, enough to keep the fish from sticking to the pan; lay the fillets in it, season them with pepper and salt, and squeeze the juice of a lemon over them; then cover with a dish, and leave plenty of room for soft cooking. In ten or twelve minutes they will be ready. Take up with a slice, garnish with parsley, and serve hot.

Vegetable Marrow Soup.—Pare, seed, and quarter a moderate-sized marrow, and put it into a stewpan with light stock to cover it, an onion, and a little pepper and salt. Let it simmer gently until quite soft, then rub it through a

sieve, and mix with the pulp a little more stock. Make it hot, and add at the last moment about a pint of boiling milk.

Boiled Fowl or Chicken with Mushrooms.—When well cooked this is a dainty dish, and it is very wholesome and digestible. The bird should be plucked and drawn with great care; indeed, a chicken needs to be handled very gently, because the skin is so tender that it tears very easily. Truss it quite firmly, rub the breast with a cut lemon, and wrap the bird in a floured cloth, plunge it into hot water, and when it boils draw the pan back, and simmer gently till done, skimming occasionally. It will take three-quarters of an hour or longer, according to size, but the more slowly it is cooked the better it will be. It will be more tasty if an onion and a small bunch of herbs be put in the water with it. Before serving, a little sauce may be poured over it, and the rest may be sent to table in a boat. Fried bacon should be served with the dish.

Mushroom Sauce.—Take about a dozen freshly gathered mushrooms, peel them, removing all the upper skin, and sprinkle salt among the gills. Let them lie in a cool cellar for two or three hours, by which time the salt will have drawn from them a rich dark-colored juice, probably enough to cook them in; but if there is not, half a cupful of boiling water or stock may be added. Simmer for a few minutes, season with pepper, and serve either poured over the chicken or in a separate dish.

Spinach.—Wash the spinach in several waters; this is necessary because it has a good deal of grit hanging about it. Afterwards trim it carefully, and remove the stalk from every leaf; if fully grown, the vein that runs up the leaf will need to be trimmed away also. If the spinach is young, it may be boiled without more water than clings to the leaves; if old, it should be put into lightly salted boiling water. In either case it will need to be pressed down with a spoon. When tender, drain it and squeeze the water from it, then either rub it through a sieve to make it smooth or chop it finely. A few minutes before it is wanted, strain away any moisture that may have run from it with standing, put it again into the stewpan, with a tablespoonful of milk or gravy, and a little pepper and salt. Turn it about till it is hot through and has become dry. Have ready a hot mold, put the spinach into it, press it to make it take the shape of the mold, turn it into a hot tureen, and serve.

In ordinary cases, when fat is not considered objectionable, a good slice of butter should be put into the stewpan with the spinach, and the vegetable should be turned about with this until dry. For gouty subjects, however, fat in cookery is to be avoided, and for them, therefore, gravy is substituted.

Hydropathic Pudding.—Take fresh fruit in season, and stew it with a little water to make it soft. Whilst it is cooking prepare a basin or bowl to receive it. Take a slice of stale bread. Stamp out of it a round piece about the size of half-a-crown, and place this at the bottom of the basin; arrange round it in an upright position, and with an inch and a half between each, thin strips of bread cut into fingers, of a size to come to the top of the basin. While the stewed fruit is warm, put it gently, a spoonful at a time, into the basin, trying not to disturb the bread. Cover the surface with bread cut into dice and with crumbs, put a saucer with a weight on the top, and leave it till cold. The pudding will turn out in a shape.

Stewed Mushrooms.—Mushrooms that are to be used for breakfast will probably have been gathered over night. Peel them as soon as they are delivered, put them, with the stems sticking up, into a soup plate, and sprinkle a little salt about

the gills. Leave them till wanted. The salt will draw out of them a rich wine-tinted juice, and there will probably be enough for stewing them. If there is not as much gravy as is needed, a wineglassful of hot water and a knob of butter, or preferably a little cream, may be put with them. Stir the mushrooms till they bubble. Have ready a slice of bread toasted on both sides. When the mushroom gravy rises in the pan, the mushrooms will be cooked. Turn them at once over the toast in a deep dish, and pepper them well; they are already sufficiently salted. Either cream or broth, or a mixture of the two, may be used for stewing mushrooms thus; but the butter or cream should be used very moderately.

Sole on Toast.—Take a small sole, and lift the flesh from the bone to make four fillets. Trim these, and twist them neatly; then put them into a saucepan with a gill of boiling water, a few drops of lemon-juice, pepper and salt. Bring the water again to the boil, draw the pan back, and simmer gently for five minutes. Drain and lay each fillet on a square of toast, mix a little milk with the stock, and add a little chopped parsley; pour a spoonful of sauce over each fillet, and serve.

Sweetbread.—This food is very easy of digestion, and therefore when carefully prepared it is very suitable for those who are not in robust health. The following is a simple way of cooking it, when basting it or frying in fat is not allowable. Procure a young sweetbread, wash it as soon as it is sent in, and lay it in salt and water for an hour; then parboil it for about ten minutes. Take it up, lay it in cold water, and when quite cold, peel it and trim it, carefully removing all loose skin and gristle, and leaving only the soft white meat. Put it back again into the saucepan with stock to cover it, an onion, pepper and salt, and a little lemon-juice. Simmer for about twenty minutes, dish the sweetbread on toast, pour the sauce over it, and send rashers of bacon to table with it. A little milk may be added to the sauce if liked.

Turnip Tops furnish an excellent vegetable; their slightly bitter taste is generally approved by dainty eaters. They need to be carefully prepared, however, if they are to be enjoyed in perfection. Wash them thoroughly, and trim away all the stalks. Throw them into plenty of fast-boiling salted water, and boil them quickly with the lid off the pan till tender. Draw the water from them, pressing them well, chop finely, return them to the saucepan, dredge with pepper, and flavor with a few drops of vinegar. Toss over the fire till hot, mold in a hot basin, and serve.

Blancmange made with Skimmed Milk.—Soak half an ounce of refined gelatine in cold water, to cover it, for an hour or more. Boil a pint of milk with an inch of stick cinnamon till agreeably flavored, and sweeten it with saccharine if approved, or put a little salt with it. Pour it boiling on the gelatine, and stir till the latter is dissolved. When cold, strain the milk through muslin, and when it is beginning to thicken, put it into a prettily shaped mold, and serve on a glass dish.

Tomato Sandwiches.—Cut wholemeal bread, or white bread two days old, into slices, and butter them very lightly. Have ready some ripe, fresh tomatoes which have been cut into slices with a sharp knife and salted rather liberally. Sandwich the tomatoes between two pieces of bread and butter, press them well together, and cut into fingers. Pile them crosswise on a dish, and garnish with parsley. These sandwiches are very refreshing and appetizing.

Filleted Plaice, Baked.—Choose a thick plaice. Wash it well in cold water, and dry it in a cloth; then put it on a board, with a sharp knife remove the skin from the back of the fish, cut off the head and tail and take the flesh from the

bones, dividing it into neat pieces convenient for serving. Lay the pieces in a single layer in a buttered baking tin, pepper and salt them, and squeeze the juice of a lemon over them; then cover with greased paper. Bake in a moderate oven for ten or twelve minutes. Serve with Worcester sauce.

The fillets of many sorts of fish are excellent when cooked in this simple way. Should the small amount of butter here used tax the digestion, exchange for boiled plaice.

Sago Shape.—Soak two tablespoonfuls of sago for an hour in milk, then boil with more milk to make up the quantity to a pint. Boil till clear, add flavoring, with saccharine if desired, and stir in a tablespoonful of gelatine which has been soaked in water for an hour and dissolved. Mix thoroughly; when quite cold pour into a shape, and turn out for use next day. A little stewed fresh fruit may be served with this dish.

Minced Collops au Naturel.—Take half a pound of tender rump-steak, free from fat, skin, and gristle. Mince it well, and season it with pepper and salt. Put it into a daintily clean saucepan, set it on a gentle fire, and let it simmer very slowly in its own gravy for ten or twelve minutes, stirring it with a fork to keep it from getting into lumps. If it should get too dry, add half a gill of boiling stock or gravy, simmer two minutes longer, and serve. This very simple dish is sometimes much liked by invalids.

Rice Served as a Vegetable.—Rice that is to be used as a substitute for potato may be prepared in two ways: either it may be plainly boiled as for curry, or it may be cooked in stock, and made savory with onions, etc. Two recipes are here given, but gouty patients would do well to prefer rice plainly boiled.

Rice Plainly Boiled.—Choose Patna rice for the purpose. Wash it in two or three waters, drain it, and throw it into plenty of fast-boiling salted water. Two parts of water will be needed for a quarter of a pound of rice. Boil fast for thirteen minutes, or till the grains crush easily between the thumb and finger. Pour the water off, and let it dry in front of the fire, stirring it with a fork now and again to separate the grains.

Rice Cooked in Stock.—Take a good-sized onion, chop it finely, and fry it in fat till lightly browned. Put it in a stewpan with a cupful of rice and a quart of well-flavored stock. Let it boil, then draw the pan back, and simmer gently till the rice swells and becomes tender. As the rice absorbs the liquid, add more, and stir the rice or shake the pan occasionally to prevent burning. Season with salt and cayenne, and, if approved, add about two tablespoonfuls of grated Parmesan before serving. Also, if approved, a tiny pinch of powdered saffron or a gill of tomato purée may be stewed with the rice to color and flavor it.

Greens should be well washed and cleansed, then plunged into plenty of salted water that is boiling fast, and boiled with the lid off. When done, turn them into a warm colander, and squeeze the water from them with the back of a plate. Put them into a hot vegetable-dish, sprinkle pepper and salt on them, and cut them across several times.

Apple Mould.—Take a pound of baking apples, pare, core and quarter them, and put them into a baking dish or stewpan with a little water, and let them cook gently till soft. Whilst they are simmering, put half an ounce of gelatine to soak in a gill of water. Beat the apple to pulp, dissolve the gelatine, put it with the fruit, add a little lemon-juice or grated nutmeg, and mould when cold. If sweetness is desired, this dish may be sweetened with saccharine, and the lemon-juice may be omitted. It is to be remembered, however, that in the dis-

ease now under consideration, special caution is to be exercised in the use of sugar.

Devonshire Junket.—Heat a pint of new milk till lukewarm and sweeten and flavor it with saccharine, a tiny pinch of powdered cinnamon, and a dessertspoonful of brandy. Pour the flavored milk into the dish in which it is to be served, and stir into it a dessertspoonful of prepared rennet; then leave it untouched until it is firm. It will probably arrive at this condition in about three hours. The more rennet used, the more quickly it will turn; but the less rennet used, the more dainty the junket will be, so long as there is enough to turn it at all. Rennet varies in strength, so that it is scarcely possible to say exactly how much will be required.

Ox Eyes.—Take some stale bread, and cut a slice three-quarters of an inch thick. Toast and stamp it into rounds with the top of a teacup, and out of the middle of each one take a smaller round, the size of the top of an egg-cup, being careful to keep the bottom of the round whole. Butter a dish that can be put into the oven, lay the rings in it, salt them, then cover them with milk, and let them soak till soft. Drain away the milk, and put a raw egg in the middle of each ring; sprinkle a little pepper and salt on them, and put a teaspoonful of milk on each egg. Cover and bake in a hot oven until the whites are set, but they must not brown. If the dish on which they are baked cannot be sent to table, take up the eyes carefully with a slice, and place on a hot dish.

Boiled Tripe. Onion Sauce.—When daintily cooked, tripe is easily digested and wholesome; when insufficiently boiled, it is hard, leathery, and unpalatable. It is cheap meat, and is generally plentiful in large towns. It is partially boiled before it is offered for sale, and some people think that on this account it needs very little cooking after it is brought home. This is a mistake. The preliminary boiling which it receives from the dresser is part of the process of cleansing it, not of cooking it, and this has to be done thoroughly, because it is most necessary that tripe should be scrupulously cleansed. It can be cooked in several ways. With any of them it should, in the first instance, be blanched—that is, it should be put into a saucepan of cold water, allowed to boil, then taken out and scraped.

There are two or three sorts of tripe. What are called ''blanket,'' or ''double,'' and ''honeycomb'' tripe are the best.

To boil one pound of tripe, blanch it, then cut it into neat squares of about two inches. Put it into a saucepan with a pint of milk, and with it four onions which have been peeled and cut through into quarters; bring the milk to the boil, and simmer for at least two hours. If, at the end of that time, the tripe feels quite soft when a fork is pushed into it, it is enough; if not, it must be simmered a little longer. Take out the onions, and chop them finely. Mix a dessertspoonful of flour with a little pepper and salt to a smooth paste with cold water in a basin. Take up the pieces of tripe, and stir the hot milk to the thickening. Stir again over the fire with the onions till the sauce boils; put in the tripe once more, and simmer again for about ten minutes, or till the tripe is hot through. Serve very hot.

Potato.—A potato perfectly boiled is a greater rarity than at first sight appears. Because the work necessary thereto is easy, it is too often carelessly performed. The condition of the saucepan used for boiling has a great deal to do with the excellence of the potato. A saucepan that is used for stews and general cookery ought not to be used also for boiling potatoes. It is well to reserve a special saucepan for this purpose. Also it is to be remembered that old pota-

toes and new potatoes must be treated differently, and that potatoes that break easily are best when steamed.

To Boil Old Potatoes.—First wash and well brush the potatoes, and as each one is peeled throw it into a bowl of clean cold water: on no account let it lie in the same water with the parings and refuse. When peeling it, carefully remove the specks and eyes, and peel the skin as thinly as possible. The potatoes will be better for lying in water for a while. Take care also to cook together potatoes of an equal size. Drain the potatoes and put them into a saucepan with as much cold water as will abundantly cover them, and bring them to the boil very gently, the slower the better. When they can be pierced through with a fork, drain off the water, cover them closely with a clean, soft, cloth, put the lid on the pan, and set the pan by the side of the stove for ten minutes or so, that the potatoes may finish cooking in their own steam. Shake them a little, and serve. It must be said also that some authorities prefer to cook the potatoes at once, not leaving them to lie in water. Also some put old potatoes into boiling salted water. Both ways should be tried.

To Steam Potatoes.—Prepare the potatoes as above, put them into the steamer over a saucepan of fast-boiling water, and let them steam till a fork will pierce them. Lift the steamer off the saucepan, cover the potatoes with a cloth, let them stand two or three minutes, shake, and serve.

To Boil New Potatoes.—New potatoes are never better than when freshly dug out of the ground. For boiling, choose them of one size, wash and brush them well. As each one is finished, throw it into clean cold water. If the potatoes are not quite fresh, they will need to be lightly scraped with a knife, instead of being brushed only. Put them into boiling water, sprinkle salt over them, and boil them until they feel tender when pierced with a fork. Draw off the water, lay a clean cloth over them, put the lid on the pan, and let them stand by the side of the fire till quite dry. Serve on a hot, folded napkin, and do not put the cover on the tureen.

Roasted Potatoes.—When the fire is suited to this mode of cookery, medium-sized potatoes are excellent for eating after being buried in the ashes of an open fire for half an hour or more, according to their size. The dust should then be brushed off, and the skins burst by squeezing. It is to be noted that potatoes which have been baked in the oven or roasted in hot ashes are more valuable for invalids than potatoes boiled.

Baked Potato.—Potatoes of a moderate size should be chosen for baking, and when two or three are to be cooked at one time, they should be as nearly as possible of a size. Wash in lukewarm water, and brush until thoroughly clean. Dry with a cloth, and bake in a very hot oven until they feel soft when squeezed with a cloth held in the hands. They ought to be cooked enough in from forty-five to fifty minutes. Potatoes baked in a hot oven are more easy of digestion than if slowly baked. When ready, they should be pressed until they crack slightly, as this will keep them from becoming heavy. They should be dished upon a hot napkin.

Julienne Soup is simply clear soup which has shred vegetables thrown into it as a garnish.

To make the **Clear Soup** proceed as follows: Take two pounds of beef, without fat or skin, from the silver-side or buttock, and tie it round to make it compact. Put it into an enameled saucepan, or into an earthenware pipkin, if such a thing is at hand, and let it brown over the fire for ten minutes. Turn it once

during the time, and move it to keep it from burning, sticking a large fork into it when doing so to let the gravy escape. A few bones may be put with it, and they will be a valuable addition, provided only that they are free from marrow and fat. They should be put under the meat. Pour on three pints of cold water, and add a small tablespoonful of salt. Let come very slowly to the boil, and carefully remove the scum as it rises. Throw in a teacupful of cold water, bring to the point of boiling again, and skim again. Repeat this process three times. When no more scum rises, put in two carrots, a turnip, two onions, one leek, a bunch of parsley, four bay-leaves, and four cloves; draw the pan to the side of the stove, and simmer gently for four hours. If the scum is effectually removed in the first instance, this soup will not need to be clarified, but will be clear and bright like sherry.

If liked, half the quantity of beef can be used when making this soup, and a little Liebig's extract of meat can be stirred in at the last to make it taste stronger.

To prepare the shredded vegetables for Julienne soup, take a carrot and a turnip. Scrape the carrot, cut it into slices about an inch long, and pare these round and round in ribbons; then cut the ribbons into strips, thus making them into lengths of the size and thickness of half a match. Peel the turnip, and cut it into slices, and afterward divide these into strips of the same size. Throw the vegetables into clear water as they are done; boil the turnips for five minutes, the carrots for fifteen minutes, then drain them; throw them into the soup. Under ordinary circumstances, prepared vegetables should be fried in a little butter till lightly browned, then simmered gently in the soup. For the use of invalids, however, they are better plainly boiled, because thus cooked they are more digestible.

Vegetables already prepared for Julienne can be bought at Italian supply houses. They require to be soaked overnight, and boiled gently till perfectly tender.

It is not unusual to have a little onion and celery, cut into strips, put into Julienne garnish, as well as turnip and carrot. To make a change, asparagus tips can be added in spring, peas in summer, and French beans in autumn. The green vegetables ought, however, to be boiled apart from the rest of the garnish, or they will lose their colour.

Marengo of Chicken.—A Marengo of Chicken can only be produced in perfection from a young bird. It is very appetizing.

Divide the chicken into ten parts—that is, two legs, two wings, two pinions, two back pieces, and two breast pieces. The wings should be taken with the muscle belonging to them, and cut from the body slantwise, so that the flesh can be laid over the bone. The legs should be cut as long as possible.

Pour a quarter of a pint of salad oil into a stewpan, and make it hot. Throw in a shallot, a little salt, five or six peppercorns, a small blade of mace, and a pinch of herbs, and, after stirring these over the fire for a minute or two, put in the pieces of chicken, and turn them about till they take a good brown all over. Drain away the oil, and remove the herbs, etc. Pour a pint of stock over the chicken in the same stewpan, and simmer three-quarters of an hour. Now add a quarter of a pint of tomato purée, a little piece of glaze about the size of a nut, and, if they are to be had, a dozen button mushrooms. Simmer some minutes longer, and serve. When preparing this dish, it is necessary to remember that

the legs need to be cooked a little longer than the other portions of the bird. They should, therefore, be put into the oil first and taken out last.

Cauliflower with Sauce Blanche.—Boil a cauliflower or broccoli until it is mellow and tender (see Broccoli). Drain it well, and squeeze it to make it round and compact. Pour a little Sauce Blanche over it, and serve hot.

Sauce Blanche (White Sauce).—Mix three-quarters of an ounce of flour to a smooth paste with a little cold water, and pour on it as much boiling water as will make the entire quantity half a pint, stirring it well. Put it in a small saucepan, and stir it till it boils. Let it cool; add the yolk of an egg and a little salt. The ordinary way of making Sauce Blanche is to melt an ounce of butter in a small saucepan, mix three-quarters of an ounce of flour with it, and add the water and yolk of egg. Sauce thus made is mellower and richer than when made as described above. It is, however, also less digestible; therefore, when wanted for the use of invalids, it should be plainly made. A knob of cold butter may be stirred into it at the last moment if approved.

Lemon Rice Pudding.—Wash a small teacupful of rice, and boil it in a pint of milk till soft. Add a little saccharine or sugar, an egg, and the grated rind of a large lemon. Turn into a buttered dish, and bake in a moderate oven until the surface is lightly browned. Pour on the top the juice of a lemon, and serve.

Omelette.—An omelette made with two eggs is a very suitable dish for an invalid, and is very quickly and easily made. It is desirable, however, to keep one small frying-pan specially for this dish, which should never be washed out, but should be rubbed briskly before and after use with clean soft white paper.

Break two eggs into a basin, remove the specks, beat the eggs well, and put with them a little pepper and salt and a dessertspoonful of chopped parsley. If liked, a pinch of finely chopped chives, or a piece of shallot or onion the size of a pea, and minced very finely, may also be added. Put half an ounce of butter in the omelette-pan, and when very hot pour the beaten eggs, etc., gently upon it. In half a minute they will begin to thicken and look lumpy. All that is now wanted is to keep putting a fork or the blade of a knife under the omelette, and scraping it, to prevent it sticking to the pan, especially at the edges and the middle. Leave off scraping a little before it is firm all over; lift the handle of the pan, and roll the egg together, thus making a sort of cushion. Hold it high for a minute, then lower the handle of the pan, slip the knife behind the egg, turn it over, and slide it on the dish. It ought to be set or firm, outside, and almost liquid in the center. It should be eaten at once.

Apple Snow.—Take two or three apples, and bake them till they fall. Scrape out the pulp with a silver spoon, rejecting all lumps. Let it cool thoroughly. Whisk the white of an egg till it is firm enough to be cut with a spoon. Mix the egg and the apple thoroughly, and beat well to make a froth or snow; then pile on a dish and serve. Sometimes apple prepared thus is put into a shallow dish, and baked for a few minutes. The thin rind and juice of half a lemon may also be added.

Boiled Turbot.—Turbot is easy of digestion, and has a delicate flavor; when in good condition, it furnishes excellent food for invalids. The fish is at its best when cooked whole, and it would be difficult to name a more acceptable dish for a sick person than a cut taken from a boiled turbot. Small slices can be taken from it with ease, and when special dishes have to be prepared this is a convenience. The recipe here given is for cooking a small piece. It is to be noted that slices from the middle and back of the fish are the best; and a great gastronomer has

given it as his opinion that the flesh on the dark-colored side of the turbot is to be preferred to the flesh on the white side.

Take a portion of turbot, and trim it neatly. Lay it on a dish, pour half a gill of vinegar over it, add three or four peppercorns, and let it lie for an hour; turn it once or twice during the time. If possible, provide fish stock, made by boiling the trimmings of the fish in water, in which an onion, a little salt, a slice of turnip and another of carrot, and a pinch of mixed herbs have been simmered. Strain the stock, let it boil, and lay the portion of turbot in it. Let it simmer gently, but do not allow it to boil, until done. When the flesh leaves the bone easily it is ready. Drain it, and serve it on a hot dish, with Dutch or anchovy sauce. The slice of turbot may be garnished with chopped parsley and hard-boiled egg passed through a sieve.

Loin of Mutton Boned and Rolled.—A small piece of the loin of mutton, consisting of two or three chops, boned and freed from fat, and rolled compactly, furnishes an excellent small roast for an invalid. It may be wrapped in two or three folds of buttered paper, and baked in the oven, and, if well basted and carefully cooked, it will be tenderer and more full of gravy than one chop cooked separately could be. The paper should be removed a short time before the mutton is dished, in order that the meat may be colored properly. The gravy for this should be well colored and free from fat. It can be made by browning the bones of the mutton, with an onion cut small, and stewing them well in stock or water. A baked tomato is an excellent accompaniment to loin of mutton.

Browned Potato.—Peel the potatoes in the usual way, and half-boil them. Drain them before they begin to soften, and put them in the dripping-tin in the oven with the meat. Baste them now and again during the process of cooking. They will probably need to bake as long as the meat bakes. If partially boiled beforehand, they will be much more wholesome than if cooked wholly in the oven.

Seakale.—Wash the seakale thoroughly, and trim it neatly, then tie it in a small bundle with tape, as twine would be likely to cut the tender stalks. Put it into as much fast-boiling salted water as will cover it; it will take about twenty minutes to cook. Drain well, and serve on toast.

Ladywell Pudding.—(A light pudding easy of digestion.) Mix a tablespoonful of flour and a little grated nutmeg to a smooth paste with cold milk, and add a little sugar to make the pudding palatable, remembering always that for rheumatic subjects sweetness is to be avoided. Pour on half a pint of boiling milk, and stir well. When cold, add an egg beaten and half a wineglassful of sherry. Pour the preparation into a buttered pie-dish, and bake half an hour.

Baked Fresh Herring.—Fresh herrings carefully cooked furnish a very appetizing dish for breakfast and are very nourishing and wholesome. Take one dozen herrings, half with soft and half with hard roes (if obtainable so), scrape and wash the fish well, cut off the heads, split the bodies in halves, and take out the bone. Rub each half with pepper, salt, and a very little mustard, and powdered allspice. Roll each half separately, leaving the tail outwards, and pack the rolls in a china or thin earthenware jar. (A jar of the sort and size used for table salt will answer excellently.) Pound the soft roes, and mix half a pint of vinegar and a little water; throw the liquid over the herrings. Put a couple of bay-leaves on top of the fish, and bake in a slow oven for about an hour.

When herrings can be bought fresh for the morning meal—and in certain towns they are often hawked round early in the day—they are very good fried

for breakfast. When they are to be cooked thus, they need only to be scaled, opened, emptied, cleansed, have their heads cut off, be lightly peppered, salted, and floured, and laid in an ordinary frying-pan, in as much hot fat as will cover them, though less fat is often used but not with so good results. They will be done in a few minutes, and their condition must be judged by their appearance. If the fat is properly hot before the herrings are placed in it, and if they are laid on a plate covered with kitchen paper for a minute or two before being served, in order that superfluous fat may drain from them, they will not be greasy when cooked thus.

Baked Apple (see p. —.)—Serve the apple hot. In cases of rheumatic gout, food should be preferably served hot.

Tomato Salad.—Take a ripe tomato, cut it in slices a quarter of an inch thick. Mix in a spoon two pinches of salt, one of pepper, a teaspoonful of vinegar, and the same measure of oil. Baste the slices with the dressing, a few minutes before serving.

Fried Sole.—This dish is generally approved by invalids, but this mode of cookery should never be adopted unless it is certain that the fish is quite fresh. If there is the slightest doubt as to its condition, lift the flesh from the bones, and cook the fillets. Pains should be taken also to make the fish quite dry before frying it; "nothing will fry crisp that is wet."

A moderate-sized sole is the best for frying. Scrape and cleanse the fish, and dry it thoroughly. In order to secure perfect dryness, it is advisable to dredge it lightly with flour. Beat an egg, and with it brush the sole all over, then cover it with finely sifted bread-crumbs, seasoned with pepper and salt. Have as much frying fat in the pan as will cover the fish; when it boils, not before, lay the fish in it, and fry till it is a rich brown. If the fat is not hot, the fish will be greasy and limp. Should it not be practicable to provide sufficient fat to cover the sole, fry it first on one side, then on the other. Have ready a dish covered with kitchen paper, and lay the sole upon this for a minute to drain it. The time required for frying a sole will depend upon the thickness. A moderate-sized sole will take from six to ten minutes.

Braised Mutton.—Take a piece of the shoulder, loin, or best end of the neck of mutton, weighing about two pounds. Trim it neatly, so that it will stand squarely and compactly on the dish when cooked. Put a liberal slice of sweet dripping into a saucepan, make it hot, and put the meat into it, then turn it about until it is lightly browned all over. While the meat is coloring, put with it some pepper and salt, about twenty small button onions (when peeling these be careful not to cut into them), and half a dozen young carrots or turnips cut into fancy shapes or into quarters. When the meat is brown, drain away the fat, flour the mutton, pour on about a pint of hot water or stock, and stir it till it boils. Put with it a shallot wrapped in parsley, cover closely, and simmer for an hour and a half. When half cooked, put in a dozen small onions of an even size. Before dishing the meat, take out the herbs, and serve very hot. The potatoes cooked thus will be excellent.

Jerusalem Artichokes.—If a vegetable is desired in addition to those cooked with mutton, a pleasant change may be obtained by using Jerusalem artichokes. Take as many artichokes as will be required; three or four large ones will probably be sufficient. Wash, brush, peel, and trim them. If convenient, arrange to cook them in a dish that will bear the heat of the oven, and can be sent to table.

Melt an ounce of butter or sweet dripping in this, put in the artichokes, sprinkle pepper and salt on them, and bake till soft and brown in a quick oven, basting them frequently. The time required for cooking will depend on the age; young roots will be done in about half an hour. If preferred, the artichokes can be boiled in salt and water, instead of being baked. They should then be coated with white sauce.

Cabinet Pudding.—Take a breakfast-cup or small basin or mould that will hold half a pint, and butter it inside. Fill it lightly with alternate layers of stale sponge biscuits and ratafias. Just before cooking the pudding pour on a custard made with a quarter of a pint of boiling milk poured upon one egg, sweetened with a teaspoonful of sugar, and flavored with lemon and vanilla. Lay a round of buttered paper on the top of the pudding, set it in a saucepan with boiling water to come half-way up the basin; cover closely, and steam very gently till set. Turn out carefully, and pour the sauce over.

German Sauce and Lemon Sauce are both excellent for a pudding of this kind.

German Sauce.—Put the yolks of two eggs, a wineglassful of sherry, and a dessertspoonful of castor sugar into a double saucepan, that is, a saucepan with water under the vessel that contains the material to be cooked. Set the pan on the fire, and mill the sauce with an egg-whisk until it begins to thicken and rise in the pan. It will take about ten minutes.

Lemon Sauce.—Boil a tablespoonful of loaf-sugar in a gill of water to a clear syrup, add the strained juice of a large lemon and half a wineglassful of sherry.

When a superior sauce is provided for a pudding of this description, a satisfactory result will be obtained by using stale bread instead of ratafias and sponge biscuits.

Buttered Eggs.—Break two eggs into a basin and beat them lightly with pepper and salt, and half a gill of milk or cream, or half milk and half stock may be used. Melt a little piece of butter the size of a filbert in an enameled saucepan, pour in the eggs, and keep stirring them one way over a gentle fire until they begin to thicken; then lift the pan from the fire, and stir again until they are lightly set. If allowed to remain on the fire too long, the eggs will be leathery, hard, and indigestible. Turn the mass upon a slice of well-made toast, sprinkle chopped parsley on the top, and serve at once.

Sardines.—These fish furnish a very acceptable relish for breakfast, and are much liked. They may be drained from the oil in which they are preserved, and eaten with bread and butter, or they may be more daintily prepared as follows:

Drain the sardines, remove the skin and the tail, split them in halves, and remove the bone. Put the fillets of flesh on freshly made toast, and sprinkle grated Parmesan lightly on the surface. Set the toast in the oven till hot, and serve.

Stewed Prunes and Cream.—Stewed prunes are very wholesome, and when eaten with cream they are very nourishing. They are never more valuable than when taken at breakfast-time.

Prunes vary much in quality. Those which are dry and hard should be soaked for twenty-four hours before being stewed; the softer, plumper sorts do not need this preliminary soaking, although they should be washed in warm water and drained. Allow a pint of cold water and a cupful of loaf-sugar for each pound of prunes, and simmer the fruit very slowly and gently for a couple of hours or more, until quite tender and well swollen. If liked, an inch of lemon-rind, a couple of

cloves, or the juice of a lemon may be added to the syrup. When the fruit is ready, drain it and put it in a glass dish; then boil the syrup till it is thick. Half a glass of claret is sometimes added. Stewed prunes are improved with keeping for a few hours before being used.

Beef Stew.—Take as much lean uncooked beef, that has been trimmed from a joint to suit convenience, as will fill a teacup. Free it from skin, gristle, and bones, and cut it into small pieces. Provide also a teaspoonful of onion, chopped fine, a moderate-sized turnip cut into dice, and the red part of a large carrot scraped to pulp. Melt a little dripping in a saucepan, and fry the meat in it for two or three minutes to brown it; take it up, and fry also the cut-up vegetables. Put them with the meat, and barely cover with stock or water. Simmer very gently for an hour, put in three moderate-sized potatoes that have been cut into cubes; simmer half an hour longer, and serve very hot. One or two croûtons or pieces of bread fried in hot fat will be an improvement to this stew. If beef of a coarse tissue is used, it will need to stew longer.

Ox-Tail Soup.—Joint a good-sized ox-tail, and cut it into inch-and-a-half lengths. Trim away the fat, and fry the pieces in a stewpan with a little dripping for five minutes, or till they are lightly browned. Pour over them two quarts of stock or water. Bring the liquor to a boil, and throw in a teaspoonful of salt. Skim it carefully, and put with it a small carrot, a turnip, an onion, with two cloves, a blade of mace, half a small teaspoonful of dried savoury herbs, six peppercorns, and a stick of celery. Stew gently for two hours and a half. Strain the stock, and put the pieces of ox-tail into cold water to set the fat, and so facilitate its removal. Melt an ounce and a half of butter in a small stewpan, mix a tablespoonful of flour smooth with it, and add the stock gradually. Let the soup simmer by the side of the fire "to throw off the grease," and skim away the fat as it rises. Make the meat hot in the soup. Just before serving add a spoonful of liquid browning, a few drops of lemon-juice, and a glass of port. In cold weather this soup will keep good two or three days, and a portion can be made hot as required. It is very nourishing and sustaining.

Broiled Chicken.—When a special dinner has to be provided for the invalid of the family, and when a chicken is the dish chosen, it is a good plan to divide the bird in halves, and cook the two portions differently on separate days. An excellent dish may be made by broiling one of these portions, according to the following recipe. The other half may with advantage be made into a fricassee, the recipe for preparing which is given after this one.

A broiled chicken requires care. Unless the bird is quite young it should be partially cooked in the oven before being placed on the gridiron, otherwise it will be underdone in parts. Pick and singe the chicken, and divide it evenly quite through; then cleanse it thoroughly; cut off the head and neck, and the first joints of the legs, and if it is necessary to wash the bird, be sure to dry it perfectly afterward with a napkin. This being done, put the half-chicken in good position, and make it as flat as possible, so that the heat of the fire may reach every part equally, and also that there may be no danger of its sprawling in the dish. A little while before it is to be cooked, oil it all over, or brush it over with warm butter; then put it on the gridiron over a clear fire, bones downward, and keep it well basted. Begin to turn as soon as the gravy oozes out, and turn it three or four times during the process of cooking. Sprinkle with pepper and salt, and serve. It will take about twenty-five minutes. The bird will be more easily cooked in a hanging grill in front of the fire than it will be on a

gridiron over the fire. This method of cooking a chicken is not easy, but when successfully managed it is always liked.

When a chicken cannot conveniently be broiled over or before the fire, it may be baked in the oven, in imitation of broiling. When this is to be done, divide the bird, or, if liked, simply take a wing and part of the breast from a young chicken. Should there be any doubt as to the tenderness of the bird, lay the piece on a gridiron or toaster, set it over a pan of boiling water, cover it, and let it steam for half an hour before broiling. This done, lay it in a warm dripping-tin, put it in a moderately hot oven, and turn it two or three times, and baste it by rubbing it all over with butter tied in muslin each time it is turned.

A piquant sauce for serving with broiled or roast chicken may be made by mixing together two tablespoonfuls of melted butter with one tablespoonful of vinegar, a saltspoonful of mustard, the same of white sugar, and a little pepper and salt. Heat to the point of boiling, pour over the chicken, cover closely for five minutes, and serve.

Fricassee of Chicken.—Stew the portion of chicken until tender in stock or water. Cut it into neat joints and set it aside for a short time. Take a tumblerful of the broth in which it was stewed, and boil therein one large onion, or half-a-dozen small ones, half a bay-leaf, a small bunch of herbs, pepper and salt, until the broth is reduced by one-half. Mix a small dessertspoonful of flour to a smooth paste with cream or milk; after straining, mix the flavored stock with it, and stir the sauce over the fire till thick. Put the pieces of chicken into the sauce, let them get hot through without boiling, and serve.

Potato Puff.—Peel and boil three large potatoes. When soft, dry, and mealy, mash or beat them briskly with a little salt and a tablespoonful of butter till white and creamy. Add the yolk of an egg well beaten and a tablespoonful of cream or milk. About twenty minutes before the potato is wanted, whisk the white of the egg to a firm froth, mix it lightly with the mashed potato; turn the preparation into a deep dish, and bake quickly till brown. If successfully prepared, the potato will be light, puffy, and palatable.

Rice with Apricots.—This dish should be prepared the day before it is to be used. Put a dessertspoonful of gelatine to soak in a tablespoonful of water. Wash two tablespoonfuls of Carolina rice in one or two waters (this will get rid of the superfluous starch, and thus make the rice less liable to burn); then cook it with an inch of stick cinnamon in a pint of milk. Let it simmer gently and slowly in a saucepan by the side of the fire for two or three hours, and add more milk from time to time until a pint and a half has been used. Take out the cinnamon, stir in two ounces of white sugar and the gelatine melted, and mix well. Add last thing a cup of cream which has been whipped till thick. This cream is not indispensable, of course, but it makes a wonderful improvement. Take a plain tin mould with straight sides; rinse it in cold water and leave it wet, and set a gallipot, with a weight inside to keep it down, in the middle. Put the rice in the space around the gallipot, and leave it to set. Next day remove the gallipot, turn the rice on a glass dish, put stewed apricots or other stewed fruit in the center, additional fruit around, and pour the syrup over all. If a second cup of cream is not considered extravagant, it may be whipped and piled upon the fruit. It is to be remembered that to whip cream not only makes it taste richer, but also increases its bulk.

Any suitable fruit may be used to garnish rice prepared thus, although apricots are perhaps to be preferred above all; and when fresh fruit is not to be had,

bottled fruit may be used. The fruit should be gently simmered in a syrup made of sugar and water, and taken up before it is soft enough to lose shape. It should be cooked in a porcelain or earthenware vessel, not in a metal saucepan.

Porridge.—Oatmeal porridge is exceedingly wholesome and nourishing food, and people who can take it are almost sure to benefit by it. It is very easy of digestion, and constitutes most valuable food, but unfortunately not everyone can enjoy it. Its acceptability depends very much upon the way in which it is made. Yet there are many ways of making porridge, and many sorts of porridge, and the sort that suits one person does not suit every person. Moreover, we generally find that people who have been accustomed to one way of making it have a contempt for every other method, and they are almost inclined to extend the scorn to the individuals who adopt it. Four recipes for making porridge are here given, and all have been highly approved by experts. For invalid use, however, the fourth recipe is specially recommended here, because the long boiling renders the meal exceedingly digestible. Moreover, porridge prepared by recipe No. 4 is very delicate, and when taken with cream it is quite a dainty. It must be understood that there are three kinds of oatmeal—''coarse,'' ''medium,'' and ''fine.'' Individual taste must determine which of the three varieties shall be preferrred.

No. 1.—Put as much water as is likely to be wanted in a saucepan with salt. When it boils, sprinkle medium oatmeal into it with the left hand, and at the same time beat it with the right hand until the required thickness is obtained. (As tastes differ very much about the degree of consistency desirable, it is not possible to say how much oatmeal should be used.) When this point is reached, set the pan on the hottest part of the fire, and boil quickly for about ten minutes.

No. 2.—Put a quarter of a pound of fine oatmeal with a little salt into a bowl, and add cold water gradually to make a smooth paste. Turn this into a saucepan containing a pint of boiling water; stir to the boil and continue boiling for about half an hour, stirring frequently to prevent the formation of lumps.

No. 3.—Put salted water into a saucepan, aud when the water boils quickly, stir in gradually coarse oatmeal till the required thickness is obtained. If any lumps from during the process, draw them to the side of the pan and crush them out. Draw the pan back a little, put on the lid, and let the contents simmer gently till wanted. The longer the better. An hour's simmeriug is none too long, but the porridge must be stirred frequently during this period to keep it from burning to the pan; and each time after being stirred the lid must be put on the pan again. When porridge can be long boiled, less oatmeal is required, because the simmering swells the oatmeal, and makes it go twice as far.

No. 4.—Begin to make the porridge early in the morning of the day before it is wanted. A porridge pan or double saucepan is best for making porridge thus. It prevents any danger of burning. Put six tablespoonfuls of coarse oatmeal into the double pan with a pinch of salt, and let it soak for some hours till the kitchen range is at liberty. Fill the pan with boiling water, stirring it well, and keep the water boiling in the outer pan till bedtime, or for about four hours, stirring the meal occasionally. Last thing before retiring for the night, stir it well, cover it, and leave it. In the morning put it on the fire, and let it get hot enough. Porridge cooked thus is not at all troublesome to make; it is simply allowed to cook itself. Any that remains over may be kept till the next day and then heated again. Indeed it is well to make the saucepan full at first and thus save time and fuel in cooking.

Kidney and Bacon.—Allow a rasher of bacon for each kidney. Skin and core the kidney, and cut it into rather thin slices the round way. Mix on a plate a tablespoonful of flour, a saltspoonful of salt, and half a saltspoonful of pepper, and dip each slice in the mixture. Melt a little bacon fat or butter in the frying-pan, and fry the bacon very gently over a slow fire, turning it repeatedly. When done, take up the bacon, put it on a hot dish, and fry the slices of kidney in the same fat. In one minute turn them; in about four minutes they will be done enough, and may be put on the dish with the bacon. They should be slightly underdone; and unless slowly and gently cooked, will be unwholesome. Pour off nearly all the fat, mix a little flour with the remainder to make a smooth paste, add gradually as much stock or water as will make a thick sauce, stir this over the fire till it boils, and strain it over the kidneys.

A dessertspoonful of ketchup can be added to the sauce, if approved.

Savory Eggs.—Provide a small tin mould, such as a dariole-mould or deep patty-pan, for each egg. Butter the tin well inside, and cover the bottom with a savory mixture made of a slice of cold boiled ham or bacon (fat and lean together), a little chopped parsley, pepper, and salt. It may be calculated that two ounces of bacon and a teaspoonful of parsley will be sufficient for three eggs. Break one egg carefully into each tin, place the tins side by side in a saucepan of fast-boiling salted water, and poach them gently until the white is set. If boiled quickly, the eggs will be hard, and the white full of holes; whereas, it should be soft and smooth. Have ready in a hot dish small circles of toasted bread, one for each egg. Turn the eggs carefully on these, and serve. If liked, a small piece of ham can be substituted for the toast.

Sausage Cakes.—Sausages have a bad name, because they can be easily—and as bought, frequently are—mixed with inferior material. Yet they are generally liked, especially by invalids, because they can be eaten with little trouble, and are convenient, and easy of digestion. Moreover, when the skins are dispensed with, and when there is a mincing machine in the house, they can be made at home with the greatest facility, as the skins are generally considered specially objectionable by fastidious eaters, and as mincing machines are now largely used. Consequently, sausage-cakes ought to be very popular. They can be made of any good trimmings of meat, and are usually much liked when a mixture of meats enters into their composition. It is possible to make them from any high-class fragments of trimmings of joints that are available.

Take as much meat as is likely to be needed, remove the gristle, skin and sinew, and mince it till it is tolerably fine with half its weight of fat and a small proportion of bread-crumbs. Season it well with pepper and salt. Make it into flat, round cakes, about half an inch thick; flour these, and fry them for about ten minutes in a little butter or bacon fat. Serve very hot.

Savory rice is often liked with meat prepared thus, and if the cakes are made wholly or partially of pork, a little apple sauce is a relishing accompaniment.

Savory Rice.—Wash a heaped tablespoonful of rice, and stew it gently with a cupful of beef or chicken broth, an onion, and some seasoning. When soft, mix with it a cupful of milk and an egg; put it in a small greased pie-dish, and bake in a gentle oven till brown.

Apple Sauce.—Peel, core and quarter one or two good baking apples, put them in a basin, cover closely, and set the vessel in a saucepan surrounded with boiling water. Let the fruit steam till it falls; mix a little sugar and a tiny piece of butter with it, and serve. The time required for cooking the apples will

vary with the variety. If time is an object, they may be baked or boiled instead of being steamed, as they will be more quickly done. To steam them, however, is an excellent way of preparing them.

Little Batter Puddings.—Put two tablespoonfuls of flour and a pinch of salt into a basin, and mix it very smooth with cold milk to a smooth paste, adding more milk to make up half a pint, and the beaten yolk of an egg. A few minutes before the puddings are to be baked, whisk the white of the egg till firm, and turn it into the batter, endeavoring not to break the air-bubbles while doing so. Butter two or three large patty pans, half fill with the batter, and bake in a quick oven. Turn the puddings out, lay a spoonful of jam in the center of each, and serve hot. This batter will be much lighter if it is mixed two or three hours before it is wanted.

Haricot Soup.—This soup is particularly nourishing and wholesome. Soak two tablespoonfuls of white or red haricots in water to cover them overnight. (If the preliminary process has been neglected, it may be omitted, but the haricots will need to boil so much longer.) Next day put the beans into a saucepan with a pint of stock, a slice of onion, a little knob of butter, pepper, and salt, and let them cook gently till quite soft. Rub them with the liquor through a hair sieve; make the soup hot, and mix with it when boiling a quarter of a pint of boiling cream, or milk if cream is not allowed. Serve at once with fried croûtons.

Croutons for Soup.—Cut stale bread into quarter-inch dice. Place these on a greased dripping-tin, and bake till crisp and brown. Set them on kitchen paper to free them from superfluous fat, and serve. Bread thus prepared is, for soup, much superior to toasted bread cut into dice.

Cutlets with Réforme Sauce.—This dish is a simple, modified, and easily prepared presentation of the celebrated and somewhat elaborate dish, Cutlets à la Réforme. It is, however, appetizing and likely to be acceptable to an invalid.

Mutton Cutlets are generally taken from the neck of mutton. When bought ready trimmed of the butcher, they are rather expensive; but when prepared at home they are profitable, because the trimmings taken off raw can be utilized to the last scrap, and thus there need be no waste with them. To prepare the cutlets at home we need only procure the best end of a neck of mutton, chop off the thick part of the chine bone, saw off about three inches of the rib bones, separate into cutlets by cutting slantwise to the left, detach all skinny parts, little pieces of bone, and rough edges there may be, and make the ends as neatly rounded as we can. If we intend to put a frill on the bone, we scrape away about an inch of the meat from the end of the bone, and leave the bone bare; but our aim should be to make the cutlet as smooth, flat, even, and neat as possible. So far as size is concerned, it is well to remember that an ideal cutlet is three-eighths of an inch thick, three inches long, two inches broad in the middle, neatly rounded at chine end, with a bare bone protruding beyond the meat. A neck of mutton is a valuable joint to have in a house where there is an invalid, because, so long as it is sweet, it improves with hanging in a cool, airy situation, and if cutlets are taken from it as they are wanted, they can be served with different sauces, and thus variety of fare is easily secured. It is important to remember, however, when a neck of mutton is to be used in this way, that the cutlets should not be separated before they are wanted. If they are, the meat will get dry.

There are two or three ways of cooking mutton cutlets for invalids. Either they may be plainly broiled, or they may be egged, breaded, and broiled, or they

may be sauté (that is, fried in a little fat), or fried in a saucepan with a good depth of fat; or they may be cooked in the oven, or toasted before the fire in a Dutch oven. When there is a frying-saucepan of a good depth available, perhaps the method to be preferred is that of frying in a good depth of fat. Nor need it be supposed that a cutlet thus cooked will necessarily be greasy. If dropped into very hot fat—fat that is so hot that it is still, and a blue fume rises from it—they will at once become encased in a coating, which will serve to keep in the juices, and prevent the grease from penetrating to the interior. The cutlet will be cooked through in a minute or two; as soon as it is brown it will be done. It may then be laid on kitchen paper, and thus any superabundant grease which may cling to the outer surface will be absorbed. The fat used in this operation can be used again and again, if it is strained after being used once or twice, and clarified or washed in boiling water occasionally. It is, perhaps, superfluous to add that after clarification it must first be allowed to go cold, then have the impurities which will settle in a cake at the bottom scraped away. Afterward it should be gently melted down again in the oven, for the purpose of expelling any watery particles that may still cling to it.

Cutlets that are to be fried in deep fat may either be egged and breaded or simply rubbed over with flour to secure dryness. They are better to be egged and breaded an hour or two before they are fried. The crumbs must be stale, fine, and even.

Réforme Sauce.—For one or two chops take a small teacupful of ordinary thick brown sauce. Put into it two tablespoonfuls of port, a tablespoonful of red currant jelly, half a teaspoonful of anchovy, a few drops of tarragon vinegar, and, if it is to be had, a dessertspoonful of tomato. Make this hot over the fire, and serve poured over the cutlet.

Brown Sauce.—If there is no brown sauce in the house, a small quantity may be made as follows: Melt a piece of glaze the size of a walnut in half a pint of water, and for the sake of the flavor boil in it a slice of onion and half a carrot cut small, a pinch of mixed herbs, and a tiny knob of sugar. When agreeably flavored, strain the liquid; thicken it with a tablespoonful of flour mixed till smooth with cold water, boil it, and add a few drops of browning if necessary.

Or simmer any trimmings or bones there may be in water till half a pint of good stock is obtained; add glaze or Liebig's Extract, and proceed as above. It is always desirable to use stock rather than water when making sauces for invalids, who are in need of nourishing food.

Potato Snow.—Boil two or three potatoes in the usual way. When dry and floury, rub them quickly through a wire sieve, or a potato-strainer, so that they shall fall in flakes. Sprinkle chopped parsley on the top, and serve at once without disturbing them.

Vegetable Marrow Sauté.—As commonly served, vegetable marrow is very much of a fraud. It comes to table immersed in water, and more water runs from it as it stands; then the water becomes cold, and mixes with the sauce, and the result is not agreeable. The fact is that vegetable marrow is composed largely of water, and special care is needed to make it dry. The following method will probably give satisfaction. Choose a moderate-sized marrow, pierce it in three or four places with a skewer or a knitting-needle, and an hour or two before it is wanted put it into fast-boiling salted water, and boil it whole with the skin on. When soft, take it up, skin it, remove the seeds, cut it into sections, and leave it to drain for a while. A few minutes before it is wanted, melt a

knob of butter, or sweet dripping, in a stewpan, put in the slices of marrow, and shake over the fire till hot through and crisp. Put the pieces of marrow on a slice of toast, pour melted butter over, and serve hot.

Amber Pudding.—Peel, core, and quarter two large apples, and put them in a stewpan with an ounce of butter, an ounce of sugar, an inch of lemon-rind, and a spoonful of lemon-juice, and let them stew till soft. Rub them through a sieve, and mix with them the well-beaten yolk of an egg. Butter and sugar a small pie-dish rather thickly, and sprinkle bread-crumbs on the butter. Pour in the apple, and bake in a moderate oven for about a quarter of an hour. Whisk the white of the egg till firm, pile it on the pudding, sprinkle castor sugar on the top, and return to the oven for a few minutes till the icing is set. Serve at once. This pudding is generally liked with cream.

Mutton Collops with Tomatoes.—When there is a shoulder of mutton uncooked in the larder, an acceptable breakfast for an invalid may be obtained by taking one or two slices from the lean meat which lies underneath the shoulder, and which is very sweet and delicate. Cut the meat thin, pepper and salt it, and lay it in a frying-pan with a little butter melted. Cook it slowly, and turn it again and again till done enough. If gently cooked, it will be tasty and good; but if quickly cooked, it will be hard. A couple of ripe tomatoes, which have been baked in a pie-dish till soft, will be an excellent accompaniment to the mutton.

Cream Toast.—Cut three slices of stale light bread, and toast them a delicate brown. Butter well while hot; salt the toast liberally, and place the slices one upon another in an earthenware or silver dish that will stand the heat of the oven, and can be sent to table. Pour on boiling milk to cover the toast entirely, put the lid on the dish, and leave it in the oven for **five** minutes, by which time the toast will probably have absorbed the milk. Lift the slices carefully with a knife, and put a tablespoonful of thick cream on each, cover the dish again and return to the oven for ten minutes. Serve at once. The toast should be tasty, light, and very digestible and nourishing.

Baked Princesse Pudding.—Soak two ounces of fine bread-crumbs in two tablespoonfuls of sherry and an equal measure of cream. When the liquid is absorbed, add a beaten egg. Put the mixture into a dish and bake. Serve with cream and jam. If the pudding made from this recipe is considered over-rich or too extravagant, the following formula may be substituted. Boil a gill of milk with a thin piece of lemon-rind, and, when well flavored, pour it scalding hot upon two ounces of stale bread-crumbs. Add an ounce of butter, an ounce of sugar, and the well-beaten yolk of an egg. Put a tablespoonful of jam at the bottom of a small pie-dish, pour the pudding mixture over it, and bake in a quick oven till the pudding is set and lightly browned. Whisk the white of the egg to a stiff froth, pile it on the pudding in broken lumps, sprinkle a little moist sugar on it, and return it to the oven to acquire color and firmness. If preferred, a cup of whipped cream may be used to garnish the pudding instead of the white of egg.

Rolled Fillets of Sole a la Maitre d'Hôtel.—Fillet a pair of soles, and stew the bones, skin, etc., in half a pint of water, to make fish stock. Grease a baking-tin with butter. Roll each fillet with the shiny skin inside, and fasten the ends with a small skewer. Arrange them on the tin, sprinkle over them a little salt and pepper and a few drops of lemon-juice. Butter a piece of kitchen paper, and lay it on the rolls to keep them from burning. Put them in the oven

for six or seven minutes. Drain the rolls on paper, arrange them on a dish, and pour the sauce over. If the fish were not drained the sauce would not coat it properly.

Parsley (or Maitre d'Hôtel) Sauce.—Melt an ounce of butter in a stewpan, and mix three-quarters of an ounce of flour smoothly with it. Strain the fish stock, pour it on the panade, and stir the sauce till it boils and thickens. Add a tablespoonful of cream, a few drops of lemon-juice, pepper and salt. Pick, wash, and chop small the leaves of a sprig of parsley, and add it to the sauce the last thing. If there is no cream, boil the fish-bones in milk instead of water. Lemon-juice will serve to whiten the sauce.

Grenadines of Veal.—Take one pound of veal from the best end of the fillet, or from the best end of the neck. If the last-named joint is chosen, the meat can be cut from the bones, and afterwards divided into cutlets. The knuckle end of the leg will not be suitable for the dish; it will be too sinewy. Remove the skin of the meat, and divide the veal into rounds of an even size, about four inches across and a third of an inch thick. Dip a cutlet bat or broad-bladed knife into cold water, and flatten the cutlets, and lard them somewhat thickly on one side with strips of fat bacon an eighth of an inch wide and an inch and a quarter long. Clean and cut into small pieces the following vegetables: a small carrot, a turnip, an onion, a stick of celery, a sprig of parsley, thyme and marjoram, and put them at the bottom of a stewpan, with a teaspoonful of whole pepper and half a teaspoonful of salt. Lay the cutlets on the top, larded side upwards, being careful that they lie singly, and pour in sufficient stock to reach them, but not to cover them. Cover the meat with a round of buttered kitchen paper cut to fit the saucepan; then put the lid on the pan, and cook slowly for three-quarters of an hour. Every now and again the paper must be lifted, and the grenadines must be basted with the stock. At the end of the time remove the lid of the pan and the paper, and set the stewpan in the oven to brown the cutlets. Strain the stock, and boil it quickly till thick and strong. Arrange the grenadines in a circle, pour the sauce over them, garnish with rolls of bacon, and serve. The grenadines will look more attractive if they are dished on a bed of mashed potatoes, and if dressed vegetables (such as spinach or green peas, or a macédoine or mixture of vegetables) are in the center. If potatoes are served thus, the potato cakes will scarcely be required also.

Potato Cakes.—Boil some potatoes, and mash them in the usual way with butter and milk. When smooth and rather moist, form them into balls by shaking them in a cup which has been dredged lightly with flour, turn them upon a greased baking-tin, and flatten them. Brush them over with milk, sprinkle bread-raspings on them, and put them in the oven till hot and lightly browned. Take up carefully with a slice, and serve hot.

Chocolate Pudding.—Boil four ounces of chocolate in three tablespoonfuls of milk till quite smooth, and stir in while hot an ounce of butter and a dessert-spoonful of sugar. Cool, then add the yolks of two eggs. Beat the whites to a firm froth, and fold them in gently at the last moment. Whilst doing this try not to break the air-bubbles. Pour the preparation into a small greased pudding-mould, sprinkle an ounce of pounded rusks to cover it, lay a round of buttered paper on the top, and steam for about half an hour, or a little more, till firm in the center. Turn out carefully, and serve with custard sauce poured over the pudding.

Custard Sauce.—Break an egg into a bowl, and beat it till frothy. Pour over it half a pint of boiling milk; turn it into a jug placed in a saucepan of boiling water, and stir over the fire till the custard coats the spoon. Sweeten the sauce, and flavor it with two or three drops of vanilla.

Mutton Stew with Vegetables.—A tasty stew for luncheon may be made of the rib part of neck of mutton that is usually sawn off when cutlets are required for family use. Pepper and salt the meat, and put it into a stewpan which has a close-fitting lid. Butter the pan inside, and place thinly sliced Spanish onions under and over the meat. Put the lid on the pan, and stew softly by the side of the fire for an hour or more, shaking the pan occasionally to be sure that the meat is not sticking to the bottom. If gently cooked, the onion will yield enough moisture to make gravy. Take up the meat, draw out the bones, and divide the flesh into neat shapes. Take up the onions also, put half a tumbler of cold stock to the gravy, and remove the fat; thicken it with a little flour, put into it the meat, a potato cut into balls or cubes, and the onions. Simmer very gently for twenty minutes longer, till the potatoes are done enough, and serve.

Boiled Creamed Rice.—Wash two tablespoonfuls of rice in two or three waters. This preliminary operation will free it from the loose flour, and make it less likely to burn. Drain it and cook it in a porridge-pan or double boiler with three-quarters of a pint of milk (adding another spoonful or two of milk if necessary), until the grains are well swollen and quite soft. The rice should cook slowly, and should take about three hours. When ready, press it through a coarse sieve. Return it to the saucepan, and put it again on the fire. Have ready two lightly beaten eggs. When the rice boils, add the eggs gradually, stirring all the time, also a little sugar and a pinch of salt; continue stirring until the egg is lightly set and thickens. Pour the rice into a dish, and serve.

Stewed Rhubarb.—If young rhubarb can be procured, it need not be skinned. Wash the stalks well, and cut them into three-inch lengths. For a pound of fruit make a syrup by boiling six ounces of loaf-sugar with a quarter of a pint of water till clear. Put in the rhubarb, and stew very gently until it is soft without having fallen. As the pieces become soft, lift them one by one carefully into a glass dish, and when all are done, let the syrup cool. Add two or three drops of cochineal, and pour the syrup over the fruit. Forced rhubarb looks very attractive when cooked thus.

Tomato and Turnip Soup.—Cut up a pound of turnips, one onion, and three tomatoes, and boil them gently in about a quart of stock. Add either a slice of crumb of bread or two potatoes. When the turnips are tender, rub the mass through a fine sieve; add pepper and salt, make hot, and serve. This soup should be as thick as double cream. If thicker add a little more stock.

Rump Steak.—Procure a slice of steak about an inch and a half thick, and of even thickness throughout. In order to broil well, it is necessary to have a clear, bright fire; and whenever broiling has to be done, judgment has to be exercised concerning the condition of the fire, and usually it has to be looked after a little time before it is wanted. In frosty weather a steak should be kept in a warm kitchen for a couple of hours before it is broiled. Make a gridiron, that has been kept specially for meat, hot over the fire, rub the bars first with a piece of clean paper or rag, and afterwards with mutton fat, and again make it hot. Season the steak with pepper and salt, lay it on the gridiron, put it as near the fire as possible, and with the steak-tongs turn it every minute. When the outside is

done, lift it a little farther from the fire for a minute or two, but continue to turn it frequently. It is scarcely possible to say how long a rump-steak will take to broil, because the time will vary with the heat of the coal, the condition and thickness of the steak, and the weather. Under favorable conditions a steak of the kind now under consideration will be done enough in from eight to twelve minutes. When it is very brown on the outside, and when it feels firm, not hard, to the touch if pressed with the side of a fork, it is probably done. It ought to be red and full of gravy in the middle, and plump in appearance, and dark brown, almost black, on the outside. If liked, a pat of fresh butter may be put under it, and another upon it; while the juice of half a lemon, and a tablespoonful of Harvey's or Worcester Sauce may be put with it. The last named ingredients should, however, be heated separately in a cup in the oven before being used. Or, if preferred, a shallot finely shred may be put under the steak, or finely chopped parsley; drops of lemon-juice may be sprinkled over it, little pieces of butter may be laid here and there on it, and it may be put in the oven long enough to melt the butter; or it may be garnished with sliced lemon and parsley, or watercress. If daintily garnished, a broiled steak may be made to look very attractive. Fried potatoes are particularly suitable for serving with it.

Fried Potatoes.—Kidney potatoes should be chosen for this mode of cooking. For frying, potatoes may either be cut into round slices about the thickness of a five-cent piece (in which case they would be called "chips"), into square plugs about the thickness of a finger, and two inches long; into ribands (in which case the tuber must be pared round and round as one would pare an apple, being careful to break the ribands as little as possible); into wedges about the shape and size of a quarter of an orange; or they may be cut thin and puffed out like small balloons, when they will be Potato Soufflées. The variations named will depend chiefly upon the mode of cutting them. The frying should be done in a deep saucepan with a good depth of fat. Some people have an idea that if potatoes are cooked in fat they will be greasy. There is no necessity for this. If the fat is at the right temperature they will be crisp, brown and dry. When fried potatoes are greasy, the reason usually is that the fat in which they were fried was not hot enough.

Clarified dripping is the best fat that can be used for frying, and the saucepan should be about one-third full. Potatoes contain so much water that hot fat rises and splashes when they are introduced into it; and therefore it is not safe to have the pan overfull. If a frying-basket is available, the operation of frying will be much easier. If it is not, the potatoes must be put into the fat a few at a time, and taken up with a slice when brown. Even when a basket is used, a single layer only of sliced potatoes should be fried at one time.

After being cut to the required shape for frying, the potatoes should be laid in cold water for a while. This will free them from the potato-flour, which is liable to spoil the frying. They must, however, be thoroughly dried afterwards by being laid between the folds of a cloth, or they will not become properly crisp. When the fat is hot—so hot that it is still, and a blue fume rises from it—the potatoes may be lowered into it. They should be shaken now and again, and when lightly browned they are done, and can be put on paper and set before the fire for a minute to ensure perfect dryness. Before being served a little salt should be sprinkled over them.

Potato Plugs and Potato Soufflées must be finished different from other shapes.

They must be fried twice. For the first frying the fat must not be quite as hot as usual, and in this they must be fried until they are cooked without being brown; they should then be lifted out until the fat is made very hot, so hot that it would register 400°. (For ordinary frying, it will be understood, fat should rise to 345° Fahrenheit, the homely sign of its having reached this temperature being that it has ceased bubbling, and a blue fume rises from it. When it reaches 400° the "fume" will become more distinct.) When plunged into the fat a second time the slices will inflate, and the plugs will become crisp and brown.

Blancmange with Cream.—Put about three-quarters of an ounce of gelatine to soak in cold water to cover it. The quantity of gelatine required will vary with the season. In hot weather an ounce of gelatine will be needed for a pint of liquid; in cold weather half an ounce will be sufficient. When it is neither very hot nor very cold, three-quarters of an ounce will probably be required for the quantities given here. On this point, however, it is necessary to exercise discretion, because the excellence of blancmange depends upon its being stiff enough to turn out without breaking, and at the same time soft enough to melt in the mouth, without needing to be bitten by the teeth.

Whilst the gelatine is soaking, take half an ounce of sweet almonds, with three or four bitter ones. Blanch them, and pound them in a mortar to a paste, and whilst pounding keep sprinkling cold water over them to keep them from oiling. Boil the soaked gelatine with a pint of milk, and add a strip of lemon-rind, and an inch of stick cinnamon; if liked, these flavorings can be used instead of the almonds, but the true old-fashioned blancmange is always flavored with almonds. Sweeten the milk, and lay the almond paste in it; let it stand till it is pleasantly and rather strongly flavored therewith. Strain the milk through muslin or a thin napkin, stir about a gill of cream to it, and mould it when it is completely cold and beginning to thicken. Sometimes blancmange is made with milk only, and cream is served with it.

If preferred, blancmange may be made from cow-heel instead of from gelatine, as follows: Procure a dressed cow-heel, and cut it up. Put the pieces into an earthenware jar, pour a quart of milk over them, cover closely, and stew in a gentle oven for a little more than three hours. Blanch and pound half an ounce of sweet almonds and three or four bitter ones, and put the paste in the milk to extract the flavor. Sweeten pleasantly, strain, and mould when the blancmange is completely cold and beginning to thicken. Serve with cream.

The meat of the cow-heel can be warmed with onion sauce, and served separately.

Chicken Livers and Bacon.—When fresh chickens' giblets can be obtained (and they are sometimes to be bought, while sometimes they are available in the ordinary course of things) a tasty dish for an invalid may be made from the livers. Cleanse them carefully, removing the gall and all yellow parts, washing them in two or three waters. Cut them into slices, the size of half a crown and about a quarter of an inch thick, and take an equal number of pieces of fat bacon. String them on short skewers, alternating the pieces of liver and the pieces of bacon, dip them in melted bacon fat or dissolved butter, wrap the skewers in buttered paper, and bake very slowly either in a Dutch-oven before the fire or in an ordinary oven till done. Pour the gravy which runs from them over them, and serve at once. Sometimes very thin slices of apple and of onion are put in alternation with the liver and bacon cooked thus.

Soft-Boiled Eggs.—If chicken livers cannot be obtained, a soft-boiled egg may be substituted for them. Next to milk, an egg is perhaps the most valuable food for invalids that we possess. Yet its excellence depends, to a great extent, upon its being properly cooked. If it is to be easily digestible, it must be gently cooked. If cooked quickly at a high temperature it will become tough and hard. Moreover, its quality must be considered when calculating the time required for cooking. The accepted rule that "an egg should boil three minutes" does not answer for all eggs, stale and fresh alike. New-laid eggs need four minutes to set; eggs that have been kept for some days will need only three minutes. Also it is to be remembered that if an egg is to be equally cooked, it must be freely covered with water; it does not answer to boil an egg in a small quantity of water, so that the shell is only half immersed. The proportion of water needed for one egg boiled in a small saucepan is one pint, although a smaller proportion of water can be used if a number of eggs are to be boiled.

An approved way of cooking eggs for invalid use is to the following: Put enough water into a saucepan to cover the eggs abundantly, and make it fully boil. Lower the eggs gently into it, and place the saucepan without the lid on the hearth, or the back of the stove, or in some other place where the water will cease to boil, yet will not lose its heat too quickly. In ten minutes the heat will have penetrated to the center of the egg, the white will be tender and firm, yet sufficiently cooked, and not in the least tough, and the yolk will be thick and delicate in flavor. Even if the egg should, through inadvertence, be left a little longer in the water than ten minutes, it will not become hard unless the temperature be raised.

Stewed Prunes.—Wash the prunes,, and if they are very dry soak them all night in cold water to cover them. Allow a pint of water and six ounces of loaf-sugar for every pound of fruit. Boil the sugar and water together for a few minutes to make a clear syrup, put in the fruit, and simmer gently for a couple of hours, or till the prunes are quite soft. Take them up with a spoon, and put them into a dish; boil the syrup a little longer until it begins to thicken, then pour it over the fruit, and serve when cold. **See also** p.

Tripe a la Coutance.—(See also Index.) Take one pound of thin tripe, and blanch it as if it were going to be cooked in the ordinary way. Drain it, wipe it dry, and cut it into pieces two inches wide and four inches long, chopping finely the following ingredients separately, then mixing them well together—a shallot, a small onion, and two or three sprigs of parsley. Take also half a pound of bacon, and cut it into thin slices the same size as the strips of tripe. Sprinkle a little of the savory mixture over each piece of tripe, with pepper and salt; lay a slice of bacon on the top, form into neat rolls, and fasten each either with needle and cotton or string. The pieces must be straight at the ends.

Put a pint of stock or water into a stewpan. Wash and cleanse or scrape a carrot, a small onion, and two or three mushrooms. Chop them small, and put them, with a bunch of herbs and three or four pepper-corns, into the stock. Stand the rolls of tripe round the inside of the saucepan, and let the vegetables be in the middle, bring to a boil, and simmer for two hours. Take up the tripe, and strain the gravy, thicken it with little flour and butter, add a few drops of liquid browning, a teaspoonful of Harvey, a teaspoonful of ketchup, and a few drops of lemon-juice. Let the tripe get hot once more in the sauce. Rub the carrot that has been strained out of the sauce through a wire sieve. If it is of a good

color it will look like red rice, and can be used to garnish the rolls. Place the small rolls of tripe on end upon a dish, with a little purée of carrot on each, and cooked vegetables (mashed potatoes or cauliflower) in the center. The string should not be removed from the small rolls directly the tripe is taken up, or they will fall.

Milky Rice.—Rice pudding made without eggs, and prepared in such a way that when finished the milk is thick and rich like cream, is very nourishing and wholesome. In order to prepare it successfully, it must be slowly baked; that is, it must be put into an oven that is so gentle that the grains will not simply become soft, but that they will swell as they soften. A little knob of butter the size of a threepenny-piece should be put with it. It is to be remembered that so long as the rice cooks at all, the more slowly it is cooked the better. Another thing to remember is that the rice should be washed in two or three waters before it is cooked; it should have a tiny piece of butter put in the dish with it, and it should not be stirred after it is put in the oven. If these precautions are observed, it will not be likely to burn, even though it should be long in cooking. For a milky pudding two tablespoonfuls of rice will be sufficient for a quart of milk. A little sugar and a pinch of salt should be mixed with the milk in the first instance, and an inch of stick cinnamon and a little lemon-rind may be allowed for flavoring. Rice that is very slowly cooked is usually done when it is covered with a brown skin. If the oven is overhot, the pudding-dish may be placed in a dripping-pan containing boiling water, the supply of water being maintained. This will moderate the heat.

Boiled Halibut.—This fish is easy of digestion, and has a delicate flavor. When quite fresh it furnishes excellent food for invalids. Take the quantity of fish that is required, wash it quickly, and divide it into pieces convenient for serving. Put it into a wire vegetable-basket, or lay it on a strainer, then lower it into a saucepan of boiling salted water; draw the pan back, and simmer till done. (A pound of fish will probably need to simmer about fifteen minutes; the exact time will depend on the thickness.) It must not boil fast at any time. When done, lift it up, let it drain, and serve it at once with a sauce made as follows poured over it:

Simple Fish Sauce.—Put a tablespoonful of butter and half a tablespoonful of flour into a small saucepan, and let them simmer together for two minutes. Pour in gradually half a pint of cold water, and stir it till it boils. Add, off the fire, a tablespoonful of chopped parsley, or the grated yolk of a hard-boiled egg, a few drops of essence of anchovy, or a little lemon-juice. Serve at once.

Plain Boiled Mutton with Parsley Sauce.—Mutton is most suitable meat for an invalid, and boiled mutton is particularly so, because when well cooked it is very easy of digestion. It is, however, very easily spoiled in the cooking, and, therefore, it requires great care. A piece from the best end of the neck of mutton is very suitable for boiling. It is always well to cut off the scrag, because this portion needs to boil longer than the chop end. The joint should, however, have a good deal of the fat trimmed away, as the fat will swell in cooking, and will be very objectionable. The chops should be well jointed also, and before being put into the pot a string should be tied round them to keep them in position. Plunge the mutton into boiling water sufficient to cover it; bring it to the boil, remove the scum, and afterwards keep it simmering gently till done. If it is allowed to boil fast it will be spoilt. Fully a quarter of an hour to the pound

should be allowed for boiling. The joint will look neater if the chine bone is cut off before cooking, and if the ribs are shortened somewhat.

Apple Charlotte.—This dish is old-fashioned, but it is both dainty and wholesome. Good cooking apples—that is, apples that fall well—are needed for making it. It can be most readily made in a mould; a cake-tin will answer the purpose. The apples should be peeled, cored, and stewed to pulp, then tossed over the fire with sugar and a little butter until the pulp begins to be stiff. It is not possible to say how much butter or sugar should be put with the fruit, because apples vary very much in sweetness and quality. What is wanted is a pleasantly flavored, smooth apple-sauce, mellowed and enriched with butter. Take some fingers of stale crumb of bread, and fry them lightly in butter. The bread should be cut into shapes like the pieces of a wooden pail, and should be arranged either to fit exactly into the mould or to make the staves overlap each other. The mould should then be filled with the apple-sauce. Put a lid of lightly fried bread on the top, and bake for about an hour, or until the bread and butter have assumed a golden brown tinge; then turn out carefully, and serve with cream.

The above is the orthodox way to make Apple Charlotte. A much easier and simpler, yet a very excellent, method is the following: Butter a pie-dish thickly, and sprinkle plenty of brown sugar over the butter, then line the bottom and sides with thin slices of bread and butter. Fill the dish with good-falling apples that have been peeled, cored and cut into thick slices; sprinkle a little sugar over, and moisten with lemon-juice. Put a lid of buttered bread on the top, and bake in a good oven. The bread should be like coffee, crisp and brown, but not at all burnt. It is essential that the dish should be buttered and sugared thickly, and that the Charlotte should be cooked in a good oven.

Thinned Milk Arrowroot.—Take three teaspoonfuls of the best arrowroot (none but the best will answer for this recipe) and half a pint of milk. Mix in the arrowroot quite smooth, and boil it up, stirring it well until it is quite cooked. It will be very thick. Take it off the fire, and let it stand till it is cool enough to drink; beat it up with a fork or whisk, and stir in well half a teaspoonful of maltine; in about half an hour it will become quite thin, and will be ready for use. A little cinnamon boiled in the milk will make a good flavoring.

Boiled Celery.—Celery is a favorite vegetable, and it is much more digestible when boiled than when eaten raw. Choose heads that are well grown, and not woolly inside. Cut off the outer sticks, and trim the stalk neatly, then cut them into pieces about four inches long. Wash them very carefully, and blanch them by boiling them in salt and water for a few minutes; drain, wash again, and boil gently till quite tender in well-salted milk and water. Use the liquor in which they are boiled to make sauce by thickening it with a little flour. Dish the celery neatly on toast, pour the sauce over, and serve.

Flaked Haddock.—Boil a fresh haddock in the usual way, and when cooked lift the flesh from the bones, and let it fall into flakes. Season it daintily with pepper and salt, and sprinkle a little lemon-juice over it. Have ready a little plain fish-sauce (see p. . . .); for a cupful of prepared fish a cupful of sauce will be needed. Toss the fish and the sauce together, arrange the mixture on a dish that can be sent to table, put bread-raspings on the surface, and bake in a hot oven for about a quarter of an hour.

Baked Pears.—Choose large, sound iron pears; peel, halve and core them, and put them in an earthenware jar with some thin strips of lemon-rind, half a pound

of sugar in lumps, and as much water as will nearly cover them. Put them in the oven when the cooking for the day is done, let them remain all night, and cook gently till tender. To make hard baking pears red without using cochineal it is necessary to bake them a long time—say, about twenty-four hours. If cooked even longer than this they will not hurt, if only they are gently baked.

Cup Custard.—Boil half a pint of milk with a quarter of an inch of stick cinnamon, and when it rises in the pan, pour it upon a lightly-beaten egg that has had the speck taken from it. Add a pinch of salt, and sugar to sweeten the custard agreeably, strain into one large or two smaller cups, place them in a deep baking-tin in the oven, pour boiling water round them, and let them steam thus till firm in the center. If properly cooked, the custard will be smooth throughout, like cream, not at all "honeycombed" or watery, and very wholesome and digestible. Instead of stick cinnamon, the custard may be flavored with a variety of substances, amongst which may be named grated lemon or orange-rind, grated nutmeg, almond or vanilla extract. Cup custard may be served hot or cold.

Roast Pigeons.—Take two young pigeons. Procure house pigeons if they are to be had, and be careful that the birds are young and freshly killed. They quickly lose their flavor if kept. Put inside each a forcemeat ball made of bread-crumbs, a little butter, chopped parsley, pepper and salt. Truss firmly with the legs forward, the wings to the side and points turned over the back, and pass string round the skewers. Hang the birds back to back, breast downwards, baste freely with good dripping or butter, and draw gradually nearer the fire. Ten minutes before taking them up, turn the birds, so that the backs may be cooked. When the steam draws to the fire it is a sign that they are done. They will take from twenty to twenty-five minutes. Serve on a hot dish with a little gravy over them, and more in a tureen.

French Beans.—These should be young and small; they can then be cooked whole, and will not need to be strung. Have ready plenty of fast-boiling salted water, throw them in, and boil quickly, with the lid off the pan, till tender. They will take about a quarter of an hour. Drain thoroughly, and serve hot.

French beans are greatly improved by being tossed in butter after boiling. They are then named French Beans Sauté. Melt a slice of butter in the pan (two ounces of butter will be needed for each pound of beans), throw in the drained vegetables, and toss them over the fire for five or six minutes. A little lemon-juice may be added last thing. This mode of cookery is scarcely suitable for the dyspeptic.

When scarlet-runners are used, they must be "strung" (the stringy edges removed by nipping off the ends and stringing along the edges), then cut into thin strips lengthwise, and boiled like French beans.

Lemon Jelly.—Soak half an ounce of gelatine in one pint of water for an hour. Prepare the very thin rind of the lemon (the rind should be cut so thinly that it can be seen through, or till it is equally yellow on both sides). Take also the strained juice of two small lemons, two ounces of sugar, or more according to taste. Put all these ingredients into a saucepan, with the whisked white and crushed shell of one egg, and stir until the liquid rises in the pan. Let it simmer a minute, draw it back, and let it stand for a quarter of an hour, then pour it into a jelly-bag or napkin, and, without disturbing the sediment, let it drip through. When quite clear, add a glass of sherry and a tablespoonful of brandy, if approved, and mould the jelly when it is on the point of setting. Sometimes a

couple of cloves and a tiny piece of stick cinnamon are used for flavoring as well as lemons.

Celery Soup.—Wash a single head of celery, cut it into inch lengths, put it into a saucepan with a small onion, and a slice of butter. Cover closely, and let the vegetables ''sweat'' for a few minutes over the fire to draw out the flavor; and shake the pan now and again to keep them from burning. Drain off the fat, and in its place put about a pint of water or the stock in which a leg of mutton or a fowl has been boiled, and simmer till tender. Rub the soup through a sieve. Mix a dessertspoonful of flour to a smooth paste with cold water, and add boiling milk to make a pint of white sauce. Mix this with the celery pulp, add pepper and salt and a quarter of a pint of cream; make hot, and serve.

Water Toast.—Toast four thin rounds of bread. Have ready a little boiling water well salted. Dip each slice quickly in and out of the water, then butter it well, and pile the slices one upon another in a silver or metal dish that has been made very hot. Serve as hot as possible. If the toast is allowed to get cold and clammy it will be disagreeable, but if hot and slightly crisp it will be excellent eaten with apple.

Apple Compôte.—Wash, pare and core without breaking any number of good, well-flavored apples of an equal size. Stew them gently in a pie-dish with water that does not quite cover them, and allow a thin strip of lemon-rind and two large lumps of sugar for each apple. Cover the apples while in the oven, and bake them gently until they are soft, but not broken. Look at them frequently; when nearly done take them out of the oven before they can fall and put them in a glass dish. Boil the syrup with a pinch of soaked gelatine and half a glass of sherry, and pour it round the apples when cold. Put a little bright-colored jelly or a knob of cream on the top of each apple. Wellington apples answer excellently for this dish, because they are very white when cooked, and therefore look pretty.

Oatmeal Muffins.—Take a cupful of cooked oatmeal (cold porridge that is thoroughly well boiled and rather dry will do for this purpose); beat the oatmeal well with a cupful of milk, added gradually. Stir into it a saltspoonful of salt, two tablespoonfuls of sugar, a pint of flour that has been well mixed with two teaspoonfuls of baking powder, and a lightly-beaten egg. Add more milk if necessary; a moderately thick batter is required. Last of all, stir in a tablespoonful of butter melted; beat for half a minute, and bake immediately in well-greased pans or muffin-rings in a hot oven for half an hour. These muffins are to be eaten hot.

Sardines with Oil and Vinegar.—Take as many sardines as are likely to be wanted from the tin, drain them well, remove the skin, and take up the flesh in fillets. Cleanse thoroughly a small quantity of lettuce, or a little mustard and cress. Dry it perfectly by tossing it in a dry napkin, and shred it finely. Mix the salad with oil and vinegar, put it on a dish, arrange the fillets of sardines upon it crosswise, to make a sort of trellis, and sprinkle chopped gherkins on the top.

Boiled Spanish Onions.—Take the requisite number of Spanish onions of uniform size, peel them, and boil them gently in salted water for two or three hours till tender. Drain them, and put them in a hot dish. Have ready a little Maitre d'Hôtel butter, put a piece about the size of a filbert on each onion, and serve.

Maitre d'Hôtel Butter.—Pick some leaves of parsley from the stems, wash them well, and chop finely. After chopping, wash a second time by putting the parsley in the corner of a cloth, dipping it in cold water, and wringing it dry. The second washing removes the acrid taste which is sometimes present in fresh parsley. Put the parsley on a plate with its bulk in fresh butter, a little pepper and salt, and a few drops of lemon-juice. Work the ingredients together with the point of a knife till the mixture is smooth, and of the consistency of very thick cream, when it will be ready for use. If the butter is prepared before it is wanted, it must be kept in a cool place, as if melted it would oil and be spoilt. In order to avoid this mischance it is necessary to mix it in a cool place.

Baked Slips.—Soles too small for frying or filleting are usually called "slips" in the market. They are sold at a lower rate per pound than the larger fish, but they are very sweet and delicate. Scrape but do not skin them, and let them lie between the folds of a cloth to make them quite dry. Brush them on the white side with dissolved butter, sift bread-crumbs over them, and lay them white side uppermost in a buttered baking-tin, and bake till the flesh leaves the bones easily. Thus prepared, the fish will not need any sauce.

Tapioca Cream.—Stew a brimming tablespoonful of pearl tapioca in half a pint of milk; sweeten and flavor with cinnamon, and set it away to cool; just before serving add a gill of cream which has been whipped till firm. Serve with stewed fruit.

Stewed Fruit.—When fruit is allowed at all for invalids, nearly every kind may be used that is sound and in good condition, provided it is daintily stewed. Fruit should be cooked in an earthenware or porcelain saucepan. The harder sorts should have a little water put with them. Fruit stewed in the French way—that is, made into a compôte, is generally found to be acceptable to invalids. According to this method the amount of sugar needed is boiled first to a clear syrup with a little water; the fruit is then put in and simmered gently till soft, when it should be lifted into a glass dish, the syrup boiled a few minutes longer, and poured over it when cool. Compôtes should always be made with fine loaf sugar. They are delicious and refreshing, and fruit cooked thus—that is, not overcooked—retains its flavor well. The time required varies with the nature of the fruit. The softer sorts, such as raspberries and strawberries, need to simmer for a few minutes only.

Milk Soup.—Take two large potatoes, or three small ones, a leek or a small onion, one ounce of butter, an ounce and a half of crushed tapioca, and a little pepper and salt. Set a quart of water to boil. Prepare the potatoes and onion, cut them into slices, and throw them into the boiling water. Add an ounce of butter and half a saltspoonful of salt, and boil for an hour. Rub the soup through a sieve, return it to the saucepan, and let it boil again, and put with it half a pint of boiling milk. Sprinkle into it gradually an ounce and a half of crushed tapioca, boil till clear, and serve.

Pheasant.—Pluck, draw and truss the bird, and either lard it or pass it through hot fat, before putting it down to the fire, and baste it well whilst it is being cooked. It should be well done, the time required to be regulated by the size of the bird. It is usual to allow three-quarters of an hour for a good-sized bird; rather less for a small one. Send bread sauce and brown gravy to table with the pheasant.

Mashed Potatoes.—Take three or four cooked potatoes, and break them smooth-

ly, or, better still, press them through a wire sieve. Put two tablespoonfuls of milk and a knob of butter into a saucepan; boil, then stir in the potatoes, add a pinch of salt, and beat briskly over the fire for a minute or two till the mixture is dry. Serve very hot.

Thickened Milk.—Break an egg into a bowl, and put with it a pinch of salt and a little sugar. Beat it till it is light, but not foamy; then pour on it a tumblerful of boiling milk. Stir it well, add a little flavoring if liked, and serve when cool in a tall glass.

Boiled Fresh Herrings.—Boiled fresh herrings are not as well known as they deserve to be. They are very delicate and easy of digestion, and less rich than when fried or broiled. To prepare them, wash, scale and empty the fish, dip them into vinegar, and skewer them in a ring with their tails in their mouths. Lower them gently into boiling salted water, draw the pan back immediately, and simmer softly till done. They will be cooked in six or eight minutes, and should be taken up the instant they are ready, as even a little overboiling will spoil them. They should be drained, served on a hot dish, and garnished with parsley. For other ways of cooking fresh herrings, see Rheumatic Gout.

Roast Chicken.—Truss a chicken firmly, and cover it with well-greased kitchen paper, or, if preferred, bind a slice of bacon over the breast. Put it neck downwards to a clear fire, and baste it well with butter or dripping. A few minutes before it is cooked remove the bacon or paper and let it brown well. A chicken would need to roast about half an hour, a large fowl one hour. Brown gravy, made of stock or of the giblets, should be served with the fowls.

When a chicken has been procured specially for the use of an invalid, it is a good plan to divide the bird into two portions by cutting it down the middle with a sharp knife. The two halves can be cooked in different ways, to furnish two hot dishes. One-half of a chicken may be roasted or baked, and the other may be broiled, boiled or stewed.

Bread Sauce.—Prepare some bread-crumbs by rubbing stale crumb of bread through a wire sieve. Pour on it an equal measure of boiling milk, cover it, let it soak for a quarter of an hour or so, then turn it into a delicately clean saucepan, season with salt and white pepper, and boil it for a few minutes, stirring it constantly the while. Add a spoonful of cream, boil once more, and serve. Sometimes a mild flavor of onion is liked in bread sauce. When this is the case, an onion may be boiled in the milk that is to be poured over the crumbs. If approved, the onion may be finely chopped and mixed with the sauce.

Duchess Potatoes.—Bake half a dozen large potatoes, then peel them and rub the white part through a sieve. The pulp of baked potatoes will be dry and mealy, and that is what is wanted. Mash them lightly and quickly with a little piece of butter, pepper and salt, an egg, and, if necessary, a spoonful of cream to form a firmish paste. Roll this on the pastry board to make a flat cake, about the third of an inch thick; cut it into oblong squares or rounds, brush them over with milk, and bake in a greased baking-tin in a quick oven till lightly browned. Serve at once.

Liquid and Semi-Liquid Foods for Fever and Other Patients

Subject Reference

For Diets in Various Diseases, see pages 318 to 348.

For Foods for Infants and Children, see pages 538 to 569.

Beef Teas — Broths — Soups — Jellies — Gruels — Drinks.

Directions and Recipes.

Fever patients are limited to liquid and semi-liquid foods, advisable or necessary during the feverish stages of many other complaints, not popularly considered fevers. Also during many stages of convalescence the patient may be unable to bear more than this kind of food. It is therefore desirable to collect here the best recipes for food of this general description.

MEAT TEAS, BROTHS AND SOUPS.

Beef Tea.—Freshly-killed, lean, juicy beef is required for making beef tea. Shin of beef is often chosen, but it contains more gelatine than gravy. Fine steak, or the roll of the bladebone of beef, are perhaps the best portions that can be chosen for the purpose. Take away every morsel of fat, skin, gristle, etc., and leave nothing but the lean; cut this into very small pieces, put it in a jar, and pour cold water over it, allowing, as a rule, a pint of water for a pound of meat. Let it soak for an hour, when the water should be red and the meat white; then cover it closely, and set the jar in a deep saucepan with boiling water to come half-way up its height. Simmer by the side of the fire for two or three hours. Pour it out, skim from the surface with a spoon any particles of fat that may be seen, and take away the remainder with a sheet of clean paper. Season agreeably, and the beef tea is ready. If more convenient, the jar can be set in a medium oven instead of being placed in a saucepan of water.

Beef Tea.—(Another way of making it.) Prepare the meat as in the last recipe, and pour cold salted water over it. Let it soak for an hour or two, turn it into a perfectly clean saucepan, place it on the fire, and just before it begins to simmer skim it once carefully; put on the lid, and simmer for about a quarter of an hour. Strain through a coarse colander to keep back the meat only. When cold, remove the fat, and stir the broth before serving it.

Beef Tea Quickly Made.—Mince half a pound of the lean of beef, and put it into a saucepan with half a pint of water. Let it come slowly to the boiling point, simmer for a few minutes (as long as can be allowed), season, strain, clear from fat, and serve.

Beef Tea Slightly Thickened.—When the addition is allowed, beef tea may be thickened by having a little rice, barley, tapioca, or sago boiled with it. A table-

spoonful of any one of these grains may be allowed for each quart of tea. They should be well washed and drained, then cooked in the liquid from the beginning, that they may be completely incorporated therein. Sometimes beef tea is thickened with a little arrowroot or corn flour. Very coarse oatmeal that has been soaked in water overnight and simmered in beef tea till it is reduced to jelly is sometimes much liked by invalids.

Beef Tea Flavored.—Beef tea may be pleasantly flavored by boiling in it a pinch of mixed herbs, a bay leaf or a little onion, carrot, turnip, or celery, and a few peppercorns. The roots should either be chopped small or be scraped to pulp before being put into the broth.

Beef Tea with Egg.—Pour a cupful of hot beef tea upon a beaten egg, and serve.

Beef Juice.—In cases of exhaustion, the pure juice of meat is frequently administered. There are one or two ways of making it. It will not keep well; therefore a small quantity should be made at once.

Take freshly-killed meat full of gravy, remove skin, fat and gristle, and cut the lean part into thin strips. Put it into a bottle or jar, cover closely, set it in a saucepan of cold water, and heat gradually for an hour. At no time should the heat rise above 160° Fahr. Press the meat, strain out the juice and gravy, add a little salt, and serve. The liquid should be red and clear, not brown. Half a pound of fine beef should yield about four tablespoonfuls of gravy. Beef that is lightly broiled before being cut up yields more gravy than can be obtained from raw beef. The meat when done should be pink throughout, not brown, and the heat should have penetrated to the center. When cut it may be squeezed in a lemon squeezer.

Another way of preparing beef juice or beef pulp is to mince it finely, put it into a basin, and pour a small quantity of cold water over it (half a pint of cold water to four ounces of minced beef); then pound it with a spoon till smooth. Let it stand a quarter of an hour, rub it through a wire sieve, add a little salt, and serve. This may be flavored to taste.

To make beef juice with hydrochloric acid, take half a pound of good beef, free it from skin, fat and gristle, and mince it finely. A satisfactory way of doing this is to pass it twice through a mincing machine. Put into a basin a cup of water and five drops of dilute hydrochloric acid (also called "muriatic" acid, or "spirits of salt"). Stir the beef into this, and set it in a cool place. Strain, season, and serve cold. The hydrochloric acid for this purpose should be obtained "chemically pure." The dilute solution may be made "by mixing it in the proportion of five and one-half fluid ounces to fourteen ounces of water," or, more conveniently, the dilute hydrochloric acid may be obtained from the chemist and use.

Various expedients are adopted to make beef juice look inviting, and to hide its raw taste from the patient. For these purposes the juice is served in a red glass, or colored with a few drops of browning, and it is flavored with milk in which celery or onion has been boiled. It must be remembered that beef juice must be administered in spoonfuls, and that it may either be cold or warmed to a comfortable drinking, not sipping, temperature, say 110° to 120° Fahr. If it is made too hot it will be spoilt; if it boils it will curdle. But when it is to be warmed it should be put in a cup, and set in a saucepan of warm water on the fire, and allowed to heat gradually. In order to get the whole value of the meat

it is necessary either to convert the meat fiber into a pulp, as described above, by rubbing the meat through a fine wire sieve, after first mincing and then soaking it; or to predigest the meat by pancreatic or peptic ferments, directions for which are always given along with the ferment, to be obtained from the chemist.

Mutton Broth.—Take one pound of neck of mutton as lean as can be procured, or lean meat from any other part of the animal may be taken. Cut away all fat, skin and gristle and divide the meat into small pieces, put it into a stewpan with a quart of cold water, and simmer gently for three hours. Carefully remove the scum as it rises. Strain the broth, remove the fat first with a spoon, afterwards with paper; season and serve hot. If there is time for the broth to go cold before being used, the fat can be more easily removed. To vary the flavor of mutton broth, a dessertspoonful of pearl barley or of rice (if allowed), a turnip, an onion, a little celery, a pinch of herbs, or a couple of bay leaves may be stewed with the meat.

Veal Broth.—Cut a pound of knuckle of veal into small pieces, place these in a stewpan with three pints of water, and two tablespoonfuls of rice. Boil very gently for an hour and a half, or longer. If liked, to vary the taste, a few parsley leaves, a sprig of thyme and a lettuce leaf may be chopped small and simmered with the veal for five or six minutes—not longer, or the flavor will be spoilt—or a small blade of mace, a sprig or two of parsley, and one of thyme and marjoram, can be used.

Chicken Broth.—Pluck a fowl, draw it carefully, and remove everything that is not quite dainty—all fat, for example, and skin, if the bird is fully grown. Remove the head and feet also, wash the bird well, and cut the flesh into neat pieces; put these into a stewpan with rather less than two quarts of water. The liver and gizzard, after being carefully cleansed, may be cut into slices, and put with the rest. Simmer gently for two or three hours. Take out the pieces of fowl, and leave the broth until the next day. Take off the fat, and serve. Pepper and salt should be added by the nurse or invalid. If flavored broth be desired, three or four sticks of celery, a blade of mace, and a sliced onion may be stewed with the meat.

The name of this drink, "chicken" broth, is rather misleading, for a more nourishing broth can be obtained from a fully-grown fowl than from a young chicken.

Chicken and Rice Broth.—Stir a tablespoonful of cooked rice (if allowed) and a beaten egg into a cupful of hot chicken broth. Stir over the fire for a minute, but do not let the soup boil.

Chicken Milk.—Clean a fowl carefully, cut it into small pieces, and break the bones. Put it into an enameled saucepan with two or three peppercorns and a little salt, and the white part of a head of celery, barely cover it with cold water, bring it slowly to the boil, and simmer gently for four hours or more. Strain the broth into a bowl, and leave it till cold, when it should form a stiff clear jelly. Carefully remove the fat from the top by wiping this jelly with a napkin dipped into hot water and squeezed dry. Take equal quantities of the jelly and milk, put them into an enameled pan, boil, skim, and serve.

Chicken Broth Made from Giblets.—For the sake of economy, chicken broth is frequently made from the giblets of the bird—that is, from the feet, throat, gizzard, and liver. When this is done the fowl can be cooked to make a separate

dish, and excellent results can be obtained in this way. Cleanse the giblets thoroughly, and be particularly careful to skin the feet, first pouring boiling water over them, and letting them lie in it for about a minute to loosen the skin. Put the cleansed giblets into a small saucepan with a pint of cold water, adding, if approved, a sprig of parsley, a small onion, a slice of carrot, and a little celery. Simmer very gently for two hours, then strain for use. If approved, this broth may be flavored with a tablespoonful of sherry and a squeeze of lemon-juice, or it may have a teaspoonful of sago, rice or tapioca boiled in it to give it consistency.

Veal and Tapioca Broth.—Break into small pieces a pound of knuckle of veal or a calf's foot, and simmer in a quart of water until the liquid is reduced by one half. Strain and skim. Turn it into a clean saucepan with a tablespoonful of soaked tapioca, and simmer for half an hour. Salt to taste. When the tapioca is clear, take it off the fire, add an egg lightly beaten and three tablespoonfuls of cream. Stir over the fire for a minute or two, long enough to set the egg, and serve. The broth must not boil after the egg is put into it.

N. B.—The several methods of treating beef in order to obtain the greatest amount of nourishment from the meat may each and all be applied to mutton, veal, chicken, or any other wholesome meat.

It is to be remembered that the only methods which insure the whole value of the meat are those in which the pulp is prepared, or the meat is predigested by a suitable ferment. The ingenuity of the cook or nurse will show itself in covering any taste of rawness, or in rendering palatable what would else be insipid. On these points again consult the beef preparations.

Oyster Broth.—Take six or eight fresh oysters, chop them small, put them with their liquor into an enameled saucepan, pour over them a cupful of cold milk, and bring the liquid slowly to the point of boiling. Simmer for a minute or two, strain through a fine sieve, season with salt and white pepper, add a teaspoonful of cream, and serve.

Sometimes, instead of broth, a little soup is required for the invalid. For these the following suggestions are given:

Clear Soup is generally acceptable. When preparing the vegetable soups for which recipes are given, it should be remembered that if necessary the flour thickening can be omitted. In Diabetes, for example, this may be advisable. The flour is merely put in to make the soup smooth and bind the ingredients together. It is not indispensable.

Celery Soup.—Wash a single head of celery, and boil it in as much salted water or chicken broth as will cover it. When quite tender rub it through a sieve. Mix a dessertspoonful of flour to a smooth paste with a little cold water, and pour on it three-quarters of a pint of hot milk. Season with pepper and salt, add the celery pulp, and a quarter of a pint of cream. Boil up once and serve. This soup may be flavored with nutmeg.

Artichoke Soup is made in the same way. Half a bay leaf, and a little lean ham, or the bone of a rasher should be boiled with the artichokes.

Asparagus Soup is also made in the same way. The points of the asparagus should be cut off and put aside, then thrown into the soup and boiled till tender, just before serving.

Onion Soup.—Boil a large onion with two ounces of stale crumb of bread. Cook till the onion is tender. Rub the whole through a sieve, add a pint of hot

milk, season with pepper and salt, and serve. Onions are to be used with caution for invalids; sometimes they are beneficial, sometimes they hinder digestion; but in this soup they are likely to be as little harmful as can be expected.

Rice Cream Soup.—Wash two tablespoonfuls of Carolina rice, and then boil it gently in a pint of stock for about two hours, or till quite soft. A short time before it is done put a slice of onion and a stick of celery into a pint of milk, and simmer. When the milk is pleasantly flavored pour it over the rice, press the whole through a sieve, and add pepper and salt. Make the soup hot, stir a gill of scalded cream into it, and serve.

Tapioca Cream Soup.—Follow the above recipe, but substitute pearl tapioca that has been soaked overnight for the rice.

Vegetable Soup.—Take some cauliflower, asparagus, peas, or any vegetable that may be preferred, and cook it in the ordinary way. Drain it, put it in a saucepan and cover it well with milk. Let it simmer for a quarter of an hour, rub it through a sieve, season with salt and pepper, and serve.

Apple Soup.—Boil any quantity of apple in water till quite soft, and crush it to pulp. For each half pint of water used allow a teaspoonful of corn flour; mix it to a smooth paste with cold water, and add as much sugar, salt and powdered cinnamon as will flavor the soup agreeably. Stir the paste into the apple, boil five minutes, and serve hot.

It is most important that soups and broths should never be sent to an invalid with globules of grease floating on the surface. It is generally easy to remove fat from broth by skimming. If the liquid is allowed to go cold, the fat can be skimmed off with a spoon; and should small particles still remain, pieces of thin white paper should be laid for a couple of seconds on the surface of the broth, and to these the grease will adhere. As the pieces of paper one after another become charged with grease, fresh pieces should be used until no more grease remains. When broth is hot, the grease may be made to rise quickly by plunging the vessel which contains it into cold water for a few minutes.

Milk is a food of great value in sickness. When it does not digest readily it is often necessary to dilute it with whey or lime water. When it is desirable to add to its stimulating qualities, a little good beef tea may be put with it.

Whey.—Put a pint of milk into a saucepan, warm it to a little more than blood heat, or 100° Fahr.; then put with it two teaspoonfuls of essence of rennet, and set it in a warm place till the milk is set. Put the saucepan on the fire, and boil the milk again; the curd will then harden and shrink, and can be removed with a spoon.

Whey can also be made by boiling a pint of milk with a teaspoonful or two of lemon-juice or vinegar, or with a glass of sherry. The curd can then be separated from the whey by straining.

Lime water can be bought at the druggist's, or it may be made according to the directions given in the section on "The Baby." (See Index.)

JELLIES.

Jellies may be regarded as liquid foods, because they melt when put into the mouth. They are often very acceptable to invalids.

Many people have an idea that although it may be allowable to make jelly of gelatine for table use, it is necessary to stew down calf's feet when making jelly for an invalid. This involves an expenditure both of time and trouble,

and it is not an advantage if only the gelatine that is used is pure. Gelatine is always of animal origin, and it simply affords a medium for the presentation of food in an acceptable form. Its value depends more upon what is put with it than upon the material itself. The following dishes are therefore made with gelatine:

Jelly for invalids should never be made hard and very stiff. Though firm, it should be tender and soft so that it will dissolve quickly.

Beef Jelly.—Prepare beef tea or beef juice in the usual way, and either boil with it a pound of knuckle of veal, chopped, or add a teaspoonful of soaked gelatine to each quarter of a pint of tea. The gelatine should be boiled until dissolved, and stirred into the beef tea, which may then be left till firm.

Chicken Jelly is made of chicken broth, made firm with gelatine.

Wine Jelly.—Soak a tablespoonful of gelatine in a tablespoonful of cold water for an hour. Simmer a clove and a small piece of stick cinnamon about the size of a clove in half a pint of water till the liquid is well flavored, then take out the spices, bring the water to the boil, and put in the soaked gelatine. Boil and skim well. Add sugar and sherry to taste, or, if approved, sherry and a small quantity of brandy may be used. Strain the jelly through a fine napkin, and when cool mould it in china, and set it in a cool place till firm. Sometimes the juice of half a lemon is substituted for the spice in this recipe. As jelly does not keep well, it is advisable not to make much at once.

Citric Acid Jelly.—Soak half an ounce of gelatine in a gill of water for an hour. Boil three ounces of loaf-sugar in half a pint of water, and remove the scum as it rises. Put in the soaked gelatine, and boil for five minutes, again removing the scum. Pour the liquid into a basin, stir in it until dissolved the eighth of an ounce of lump citric acid, skim again, add a glass of sherry, and mould it when it is quite cold and beginning to set.

Iceland Moss Jelly.—Wash an ounce of Iceland moss in cold water, and soak it all night in as much water as will freely cover it, and to which has been added a small pinch of carbonate of soda. This will tend to take away the unpleasantly bitter taste. Take the moss out of the soda and water, and squeeze it dry, and boil it gently in a quart of water for five hours or more until the liquid is reduced to a pint. Strain it, sweeten, and flavor it with sugar, lemon-juice, and wine, and mould when beginning to get firm. Iceland moss jelly is often made with milk instead of water.

Irish Moss Jelly.—Follow the above recipe exactly. Iceland moss jelly, and Irish moss jelly, and ivory dust jelly, the recipe for making which is below, are often ordered for people suffering from lung diseases.

Ivory Dust Jelly.—Buy half a pound of ivory dust from the druggist. Stir it into two quarts of water, and boil it gently all day, until the liquid part is reduced to one pint. Pour it into a basin, and let it get cold; take up the jelly part, leaving the sediment behind; flavor and clarify in the usual way and mould when the jelly is beginning to set.

It is, perhaps, scarcely necessary to say that to clarify jelly we allow one egg for each pint of liquid; beat up the white and the crushed shell, stir it into the melted stock, and whisk over the fire until the jelly rises in the pan, draw it back, and let it stand a few minutes; then pass it through a jelly-bag or napkin, disturbing the crust as little as possible.

Hartshorn Jelly.—Follow the recipe given for ivory dust jelly.

Lemon Jelly.—Soak a tablespoonful of gelatine in water to cover it for an hour. Put it into a saucepan with half a pint of boiling water, stir it until melted, and add the strained juice of a large lemon, two tablespoonfuls of sugar, and a tablespoonful of brandy. Boil a few minutes, and remove the scum as it rises. The precise quantity of lemon-juice and sugar used must depend on the taste of the patient.

If it is thought desirable to have the jelly bright and clear it must be clarified. (**See** Ivory Dust Jelly.) The lemon-juice will, however, clarify it to some extent, and the removal of the scum will assist the process.

Orange Jelly.—Follow the above recipe, but instead of using half a pint of boiling water use a tablespoonful of lemon-juice, six tablespoonfuls of orange-juice, water to fill the half-pint measure, and sugar to taste.

Coffee Jelly.—Soak half an ounce of gelatine in half a pint of water for an hour, dissolve, and add a breakfastcupful of strong, clear coffee. Sweeten to taste, mould, add a little cognac if liked, and serve when firm.

Tea Jelly.—Follow the recipe for coffee jelly, substituting strong freshly-made tea for coffee. Tea and coffee jellies would not be nourishing, they would be simply reviving, and might serve to stimulate the appetite; invalids frequently like them very much. They are more nourishing when made with milk instead of water, and they are sometimes enriched by the addition of a little cream. Whipped cream may also be served with them.

Fresh Fruit Jelly.—Draw out and sweeten agreeably the juice of any kind of fruit. Add the juice of a lemon and half an ounce of soaked and dissolved gelatine for each tumberful of juice.

Tapioca Jelly.—Soak half a cupful of pearl tapioca in two cupfuls of water overnight. Turn into a double saucepan, or put in a jar, and set in a saucepan of water, and cook gently till clear. Add sugar to taste, and a little more water if too thick, and when taken off the fire strain in the juice of a lemon and a little wine, if approved. Serve cold with milk or cream.

Arrowroot Jelly.—Mix two teaspoonfuls of Bermuda arrowroot to a smooth paste with cold water; stir into it half a pint of boiling water, and boil for three or four minutes. Sweeten agreeably, flavor with lemon-juice, and serve cold.

Arrowroot Blancmange.—Follow the above recipe, but substitute milk for the water.

Tapioca Custard.—Soak half a cupful of pearl tapioca overnight in slightly salted water that will barely cover it. Next day turn into a double saucepan with two cups of milk, and cook gently, stirring frequently. When the tapioca is clear and quite tender pour the preparation upon the yolks of two eggs which have been beaten with two tablespoonfuls of castor sugar. Mix well, then stir over the fire for a minute or two to cook the eggs. Turn into tumblers, and serve cold.

Tapioca Cream.—Stew a tablespoonful of small tapioca in half a pint of milk, sweeten and flavor with cinnamon, and set away to cool. Just before serving add a gill of cream which has been whipped till firm, and a tablespoonful of brandy if approved.

GRUELS.

Gruels are cooked mixtures of grain, or preparations of grain and water. After cooking milk (sometimes wine) and various flavorers are added, but these extra ingredients should not be introduced until thorough cooking in water has

first taken place, and the gruel should not be allowed again to reach the boiling point after milk, cream or wine have been mixed with it. The meal may be sifted dry and just the flour used to make any of the following, but that is less economical of the oatmeal.

Superior Gruel.—Take half a teacupful of coarse Scotch oatmeal, mix it smoothly with about a pint and a half of water, pour it into a saucepan, and set it by the side of the fire to cook gently for a considerable time, three or four hours. Stir it briskly from time to time, and add a little water now and again if it becomes very thick. When done, rub it patiently through a hair sieve, and do not use portions that will not go through. Boil it, mix an equal measure of boiling milk and a little cream with it, and serve. Sugar and flavoring can be added at discretion. It is to be remembered that though a little sugar much improves the taste of gruel, very sweet gruel is disliked by nearly all sick people. A gruel not quite so fine can be made by using a rather fine colander instead of a hair sieve to strain it. The cooked oatmeal must be rubbed through the sieve or colander with a tablespoon. This makes a very light and digestible preparation.

Plain Gruel.—Put a pint of water on the fire to boil. Mix one tablespoonful of the best patent groats to a smooth paste with cold water. When the water on the fire is quite boiling, stir the paste into it, and continue to stir it for ten minutes. Season, and the gruel will then be ready for use.

Another Way.—Mix a tablespoonful of oatmeal to a smooth paste with cold water, add gradually a pint of boiling water, and boil for a quarter of an hour, or longer if there is time, stirring well to prevent the formation of lumps. Strain, season with salt or sugar, and add cream, wine or brandy, or the yolk of an egg if approved, and serve.

Another Way.—Put a cupful of oatmeal into a basin and pour cold water over it to cover it. Stir it well, let it stand a few minutes, and pour off the thin liquid into a saucepan, leaving the sediment behind. Cover again with cold water, and repeat the above process two or three times until the water is no longer charged with meal. Boil the liquid for half an hour longer, season, and for every cupful allow half a cupful of cream. When pouring off the liquid it will, of course, be necessary to be careful lest any of the rough parts of the meal should escape into the saucepan.

Barley Gruel.—Barley is a nutritious grain, and a drink made from it is in some cases very acceptable. Gruel may be made both from whole barley and from barley flour.

To make it from pearl barley, take two ounces of the barley, wash it well in one or two waters, and boil it gently in a quart of water for about two hours, or until the liquid is reduced by half. Strain it, and put it in a cool place. When wanted, season or sweeten it, and mix cream, milk, port wine, lemon juice, or flavoring with a small quantity only of the gruel. Barley gruel does not keep well, therefore it is a mistake to prepare much of it at one time.

To make barley gruel from barley flour, mix a tablespoonful of the prepared meal to a smooth paste with a small quantity of cold water, pour on a pint of boiling water, boil for ten minutes, strain, flavor, and serve very hot.

Barley Water.—Wash two ounces of barley, or, better still, boil it for a few minutes to cleanse it, and pour the water away; then simmer it gently in three

pints of water for an hour or rather less. When half done put into it a piece of lemon peel and a little sugar. Strain, and it is ready for use.

Arrowroot.—Mix a dessertspoonful of Bermuda arrowroot to a smooth paste with cold water, pour on half a pint of boiling water or boiling milk, and stir it well. Put the preparation into a saucepan, stir till it is on the point of boiling; sweeten, flavor and serve. Arrowroot may be flavored with lemon rind or juice, nutmeg, cinnamon, wine, etc.

Rice Caudle.—Mix a tablespoonful of ground rice to a smooth paste with cold water, add a pint of boiling water, and boil for a quarter of an hour, stirring well. Sweeten or season, flavor and serve.

DRINKS.

Water.—In many illnesses cold water is allowed to be used freely as a drink. It should, however, invariably be boiled and allowed to go cold before being drunk, and as boiling renders it somewhat "flat" and tasteless, it should, after boiling, be passed through a good filter which is well cleansed and recharged at stated periods (otherwise filters are quite useless), as this will aerate it again to some extent. To keep water cold in a sick room, put it in a stone jug, and wrap the vessel in a cloth kept constantly wet. Drinks for the sick are almost always most valuable when **cool**, rather than icy cold.

Toast Water.—This simple beverage is rarely well made. Take a slice of stale bread (crust is to be preferred, as the crumb will sooner turn sour), and toast it slowly all through without burning it. Let it go cold, then pour over it a quart of boiling water, and let it stand covered till cold. Strain it through muslin before serving it.

Toast Water and Cream.—Mix a tablespoonful of cream with half a tumbler of toast water. Add a little sugar, and serve cold.

Rice Water.—Wash two tablespoonfuls of rice, let it boil with a pint of water for ten minutes. Strain it off, and add a little more water, and repeat until there is no more goodness in the rice. If liked, an inch of stick cinnamon or a piece of ginger may be boiled with the rice, or a little salt may be added. A spoonful of sherry or port may be mixed with the rice water if the patient may take or needs stimulants.

Lemonade.—Lemonade is the one beverage that is more popular with invalids than any other, yet it varies very much in quality. This is partly explained by the fact that some lemons are much juicier than others; therefore the cook in making it must, to some extent, be guided by her own judgment. For superior lemonade, it may be calculated that when lemons are large and juicy three lemons will be needed for a pint of water; when lemons are small or not juicy, four lemons will not be too much. The quantity of sugar employed must depend upon taste. In average cases, for lemons of moderate acidity, an ounce of sugar will probably be required for each lemon used. It is to be remembered also that though lemonade is frequently made with cold water, it has a better flavor when boiling water is used for it. When soaking the rind for the sake of its flavor, it should not be forgotten that the minutest portion of white pith, and also the pips, are likely to impart bitterness if allowed to remain. Many cooks do not seem able to realize that thin lemon rind ought to be so thin that it can almost be seen through.

When the quantity of lemons named is considered unnecessary, the following recipe may be used: Pare off the yellow rind of a fresh lemon, and be careful not to take any of the white pith, as it would make the lemonade bitter. Put the thin rind into a jug with the strained juice of two lemons and about an ounce of loaf sugar. Pour over all a pint and a half of boiling water, and let the liquid stand till cold. Strain and serve. To make lemonade look inviting, nurses sometimes cut a very thin slice from the middle of the lemon before squeezing it, and when it has become cold serve it in a tumbler with the slice of lemon floating on the top.

A Plainer Lemonade.—Peel thinly a large, juicy lemon, and let the rind soak in water enough to cover it for an hour. Strain it, add the clear juice of the fruit and a pint and a half of boiling water. Strain when cold and serve.

Lemonade made with barley water or with rice water is occasionally much liked.

Milk Lemonade.—Put a tablespoonful of loaf sugar, two tablespoonfuls of lemon juice, and two tablespoonfuls of sherry into a bowl, and pour on a cupful of boiling water. Stir till the sugar is dissolved, add half a pint of cold milk, and stir again till the milk curdles. Strain for use.

Apple Water.—Slice without peeling a pound of apples, and boil in a quart of water till the fruit is soft. Strain through muslin, sweeten to taste, and serve when cold.

Milk and Soda Water.—Fill a glass half full of milk with soda water. Use at once.

Fruit Juice and Soda Water.—Express the juice from any sort of ripe, sound, fresh fruit, such as strawberries, raspberries, currants, oranges, apricots, peaches, apples, etc. The best way to do this is to put the fruit in a jar with a closely-fitting lid, set the jar in a saucepan with boiling water round it, and let it stew till the juice flows freely. The firmer fruits will need to have a little water stewed with them. A little sugar should be added to the juice according to its acidity. When the fruit is melted, drain the juice from it without squeezing it; put about two tablespoonfuls of the syrup into a tumbler, and fill the vessel with soda water. If a couple of tablespoonfuls of cream may be used as well as the fruit, a delicious drink will be produced.

Coffee and Soda Water.—Strong coffee mixed with cream and soda water is occasionally liked by invalids.

EGG DRINKS.

Egg Beaten up with Brandy, Wine or Milk.—Break an egg and take out the speck. Put with it a dessertspoonful of white sugar and a pinch of salt, and beat it until well mixed, but not long enough to make the egg frothy. Add a cup of slightly warm milk and one or two tablespoonfuls of brandy, or two tablespoonfuls of sherry without the milk. Strain into a soda-water glass and serve immediately.

Mulled Wine and Egg.—Put a cup of water, one clove, and a piece of stick cinnamon the size of a thumb-nail into a saucepan, and boil for ten minutes. Add a glass of wine, and let the mixture barely reach the boiling point. Have ready an egg beaten with a tablespoonful of white sugar. Pour the boiling liquid gently into the egg, and stir well. The preparation should be of the consistency

of cream. In very cold weather it may need to be put on the fire for another minute to finish cooking the egg.

White of Egg and Milk.—(Sometimes valuable in diarrhœa.) Beat the white of an egg, and mix with it a tumbler of milk, a teaspoonful of brandy and half a tumblerful of soda-water.

Egg Lemonade.—Shake together in a bottle the white of an egg, a tumblerful of cold water, the juice of half a small lemon, and a teaspoonful of white sugar. Or, beat a whole egg lightly and add a tumblerful of strong sweet lemonade.

Egg Soup.—Beat an egg lightly, and stir it into a breakfast cupful of hot broth of any kind. Season with pepper and salt.

Egg Gruel.—Beat an egg, add pepper and salt, and pour on, stirring briskly, a teacupful of boiling water.

Egg Cordial.—Beat the white of an egg to a froth, add a tablespoonful of cream and a tablespoonful of brandy. Mix thoroughly.

Egg Drink.—(This drink has often been found acceptable in cases of dryness of the throat.) Mix a tablespoonful of the best arrowroot to a smooth paste with cold water. Add two tablespoonfuls of white sugar and the whites of two eggs which have been whisked with a little water. Add boiling water to make up the quantity to three pints, boil up once quickly, and stir while boiling.

Demme's Solution of White of Egg.—(Specially useful in many children's illnesses.) The whites of two eggs dissolved in, or diffused through, one and a half pints of water sweetened to taste. Cognac may be added to this according to the physician's prescription. Without the cognac the solution will be drunk as, and mistaken for, sweetened water.

SPECIAL DIETS.

Diets suitable in several common acute conditions are here given.

The preparations and dishes here advised may be varied by giving others similar to them. The liquid foods and the drinks given in the following lists are described on page 391. Solid foods are described here as given.

DIET IN DYSPEPSIA WITH FLATULENCY.

Avoid sweets.

Take no fluids with meals.

Take half-pint hot water before each meal and again two hours after each meal.

Try Saccharine in coffee instead of sugar, and cream instead of milk. Coffee taken **clear** is preferable, however.

Avoid Tea and Alcohol.

DIET IN DIARRHEA.

Raw Meat.—Scrape the beefsteak to remove all fat and tendon. Season with salt and pepper. Roll the meat into balls with a little white of egg with as little pressure as possible, and broil for two minutes, or until the outside turns gray.

This is excellent for children with Diarrhea (not infants), also adults who suffer from irritable bowels or chronic diarrhea.

Toast Water.

IN ACUTE FEBRILE DISEASES.

(That is, diseases in which the patient is fevered.) The Diet may be selected from the following, varying it from day to day and meal to meal:

Gelatine.—Take three sheets gelatine, or one ounce. Dissolve in a pint of warm water. When thoroughly dissolved bring to boiling point, add one-half cup of sugar and the juice of a lemon, and when beginning to stiffen add the white of an egg beaten to a stiff froth. Beat until foamy and put it on ice.

Wine Whey.—Heat a pint of fresh milk to the steaming point, add slowly a wineglassful sherry wine and let it gently simmer until the curd forms. Strain the whey thoroughly through a cloth and sweeten.

Thin Soups.

Baked Potatoes.

Raw Oysters.

Toast. Toast Water.

Ice Cream.

IN FEVERS THE PATIENT MAY TAKE:

Soups, Etc.—Beef Tea, Mutton Broth, Chicken Broth.

Farinaceous Articles, Etc.—Milk Toast, Soaked Crackers, Flaxseed Tea, Potatoes and Cream, Arrowroot, Rice and Milk. (As a rule, Indian Gruel, Graham Flour and Oatmeal Gruel should not be used in Typhoid Fever.)

Drinks.—Water abundantly. Rice Water, Currant Jelly Water, Lemonade, Gum Arabic Water, Orange Juice, Egg Nogg, Champagne, Brandy, Whiskey, Tea, Milk plain or peptonized, guarded with lime water.

DIET IN TYPHOID FEVER.

Milk (Sterilized or Boiled).—Four ounces every two hours, or as the physician may direct.

Koumyss.—When this cannot be purchased it can be made by taking a champagne bottle, or one with a long neck, and filling to lower end of neck with fresh, sweet milk at temperature of new milk; add to this a quarter of cake of compressed yeast and two teaspoonfuls of white sugar; bottle and shake thoroughly, wire the cork firmly and expose to a temperature of 80° F. for six hours. Then place on ice in a cool place. Use after twelve hours.

Water (Sterilized, Boiled or Filtered).—Soda water, Apollinaris, Vichy.

Iced Champagne.

DIET IN CONVALESCENCE FROM TYPHOID FEVER.

AVOID

All solids until after crisis. In Typhoid no solid food should be given until at least a week after the temperature has become normal, and remains so, as the intestinal ulcers may remain unhealed for an indefinite time.

USE

Soft Boiled Eggs.

Thin Soups, such as beef, veal, chicken, tomato, oyster, mutton, pea, bean, squash, **carefully strained** and thickened with powdered rice, arrowroot, flour, milk or cream, egg or barley. Cream soups may be used to advantage.

Beefsteak.—Thoroughly chewed or masticated, **the pulp or fibre discarded** and only the essence or juice being swallowed.

Potatoes.—Baked with the skins on.

Gruels.—Strained cornmeal, crackers, barley-water, toast-water, water with lemon juice.

Ice Cream.

Raw Oysters. Soft part only.

Apple Sauce.

Stewed Asparagus Tops.

Jellied Cream.—Soak one-third of a box of gelatine in one-half pint of cream for one-half hour, place in a double boiler and stir over the fire until the gelatine is thoroughly dissolved; remove from the fire, add two rounding tablespoonfuls of sugar, stir until dissolved, then add a half-pint of cream and a quarter of a cup of good sherry. Pour into moulds and set in a cold place to harden.

Milk Toast. Milk.

Broths.—Mutton, Veal, Chicken, thickened with a little rice.

Bread.—As directed by physician.

Chocolate, Cocoa, Coffee, Tea.—Beverages as directed by the physician.

Eggs.—In various forms, as already directed, but never fried.

PART FOUR—*First Aid*

Accidents and Emergencies

Subject Reference

For Accidents to Infants and Children, see Vol. 1, pages 608-613.

For further Surgical Treatment of Wounds and Injuries, see Vol. 2, pages 71-122.

For Care and Management of the Sick, also Trained Nurse and General Information, see Vol. 2, pages 531-587.

Prescriptions, Vol. 2, pages 588-634.

First Aid to the Sick or Injured.

Words of Warning That May Save A Life. How to Avoid Accidents.

Bandages, Hemmorrhages, Wounds, Sprains, Dislocations, Fractures, Removal of Wounded, Artificial Breathing, Resuscitation of the Drowned, Asphixia from Gas, Poisoning, Insensibility, Fits, Burns, Scalds, Choking and Frost-Bite.

INSTRUCTION TWENTY-ONE—*Bandages*

Bandages are used:

1. To support injured parts.
2. To keep dressings in their places.
3. To fix splints and other apparatus.
4. To overcome excessive muscular action.
5. To stop bleeding by means of pressure.
6. To protect wounded parts from exposure.
7. A special use is to stop milk-secretion.

Bandages are:

1. Triangular.
2. Roller.
3. Bandages of special form.

1. The Triangular Bandage and Its Application.

To Make the Triangular Bandage.—Take a piece of linen or unbleached calico, not less than 38 or 40 inches square; fold it diagonally, and cut it along the fold. This makes two bandages. Or if the cutting be omitted, a two-ply bandage is obtained.

The named parts of the bandage are: The lower border—the base of the triangle, BC; the side-borders—the two sides of the triangle, AB, AC; the point—the apex of the triangle, A; the two ends—the ends of the triangle, B and C.

To Fold the Bandage for Stowage.—First fold it perpendicularly down the center, placing the right end on the left; then bring the ends thus folded and the point to the center of the lower border, thus

forming a square; now fold in half from right to left; and, lastly, fold in half from above downwards twice. This will give a packet 7 by 3½ inches, which may be pinned to prevent unrolling.

The Advantage of the Triangular Bandage is that it can be easily

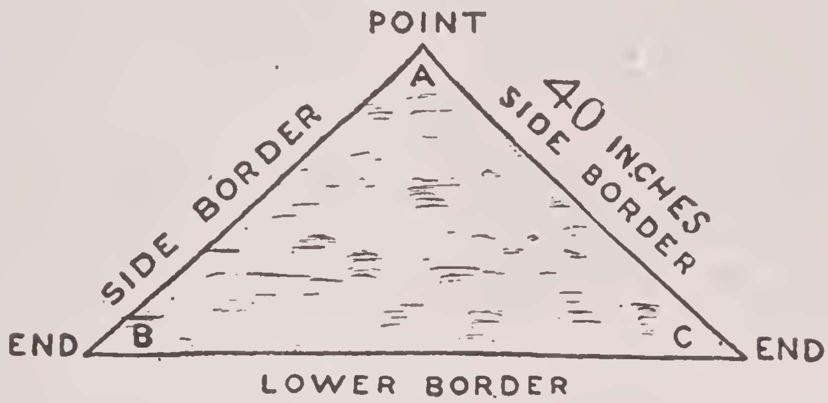


Fig. 141. The triangular bandage. B C is about 53 inches. The point is also termed the apex.

made out of a large handkerchief, and it is therefore well suited for an emergency bandage. Its method of application can be easily learnt. Temporary dressings can be applied better by it than by the

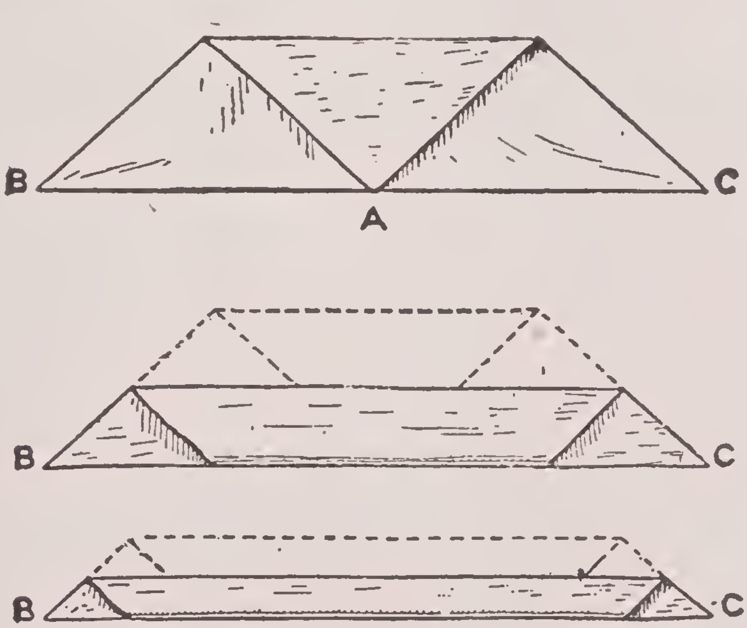


Fig. 142. Folding the triangular bandage broad and narrow. The dotted outline in each figure shows the shape before folding.

roller bandage; and it can be used for almost every purpose for which a bandage is required—viz., to retain dressings, to fix splints, to exercise pressure, as an extemporized tourniquet, and as a sling.

The Triangular Bandage May Be Used:

1. Unfolded.
2. Folded broad—the broad cravat.
3. Folded narrow—the narrow cravat.

To Fold the Bandage Broad or Narrow.—Spread the bandage out, and carry the point down to the middle of the lower border. If required broad, fold it lengthwise on itself once; if required narrow, fold it lengthwise on itself twice.

Fig. 143. How to tie the "reef" knot. (This is also termed the "square" or the "weaver's" knot.) It is an excellent knot and is easily untied by pulling one end straight.

To Fasten the Bandage After Applying It.—Either pin the bandage or tie the ends in a "reef" or "sailor's" knot; never tie a "granny" knot. (See Figures.)

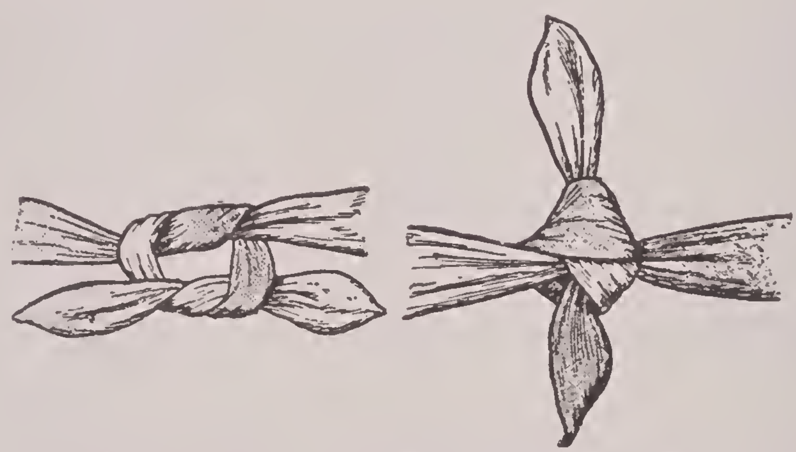


Fig. 144. The "granny" knot. This is a poor knot and is very hard to untie when drawn tight.

To Tie the Reef Knot.—Hold the ends of the bandage in the two hands, wind the end held in the right hand over that held in the left, then wind the end now held in the left over that held in the right, so that the result may appear as shown in the drawing.

The reef knot if properly tied should have its free ends lying in the same line as the bandage.

Its advantages are that it is firm, is not liable to slip, is neat, and is easily untied.

The Triangular Bandage as a Sling.—The following slings may be applied with the triangular bandage:

1. **The Narrow Arm Sling,** made by folding the bandage narrow,

placing one end over the shoulder of the injured side, allowing the other end to hang down in front. The fore-arm on the injured side is then raised to the required height, the hanging end is drawn up in front of it, and over the shoulder of the uninjured side, and the two ends are then tied, either behind the neck or over the shoulder on the injured side.

2. **The Broad Arm Sling.**—This is made by folding the bandage once, and applying it in the same way as the narrow arm sling.

3. **The Large Arm Sling.**—This is applied in three different ways:

a. **To Support the Forearm.**—Place the apex of the bandage

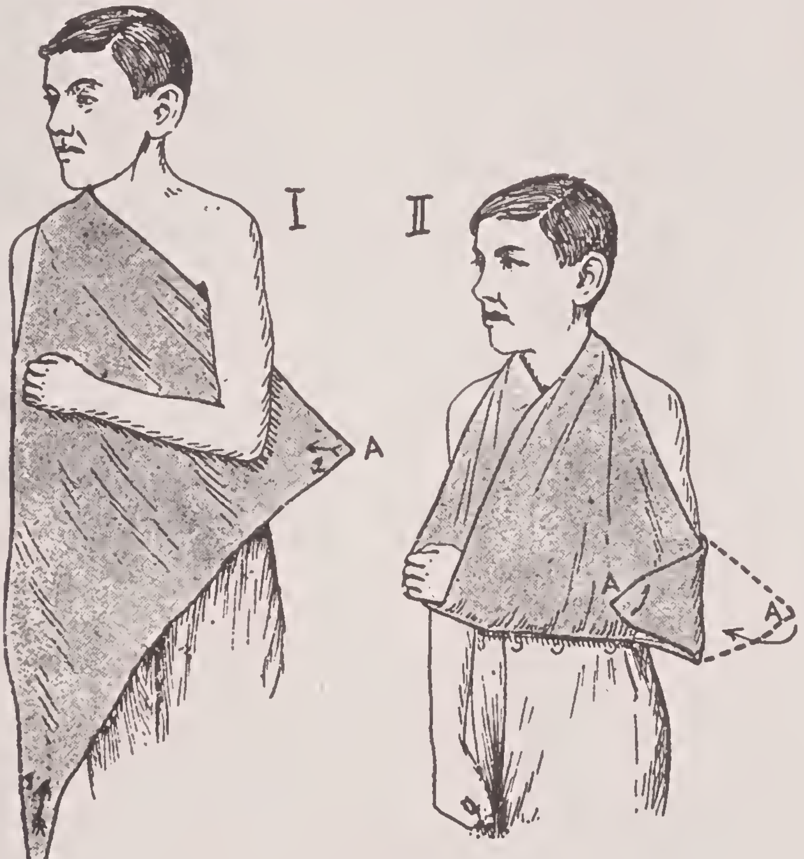


Fig. 145. The large arm sling.

below and well beyond the elbow of the injured forearm, and the upper end across the top of the opposite shoulder. Now place the forearm across the chest at the desired level; bring the lower end upwards over the forearm, pass it over the shoulder of the injured side, and tie the ends by a reef knot on top of the shoulder of the injured side, well in front; then bring the apex forward over the point of the elbow, and pin it over the arm in front.

b. **For a Fractured Collar-Bone.**—Here the sling is applied in the same way as in a; but the lower end, instead of being carried over

the shoulder of the injured side, is carried under the armpit, and knotted off to the upper end, behind the neck.

c. **To Sling the Elbow.**—Place the bandage with one end on the shoulder of the injured side, and the apex projecting well beyond the

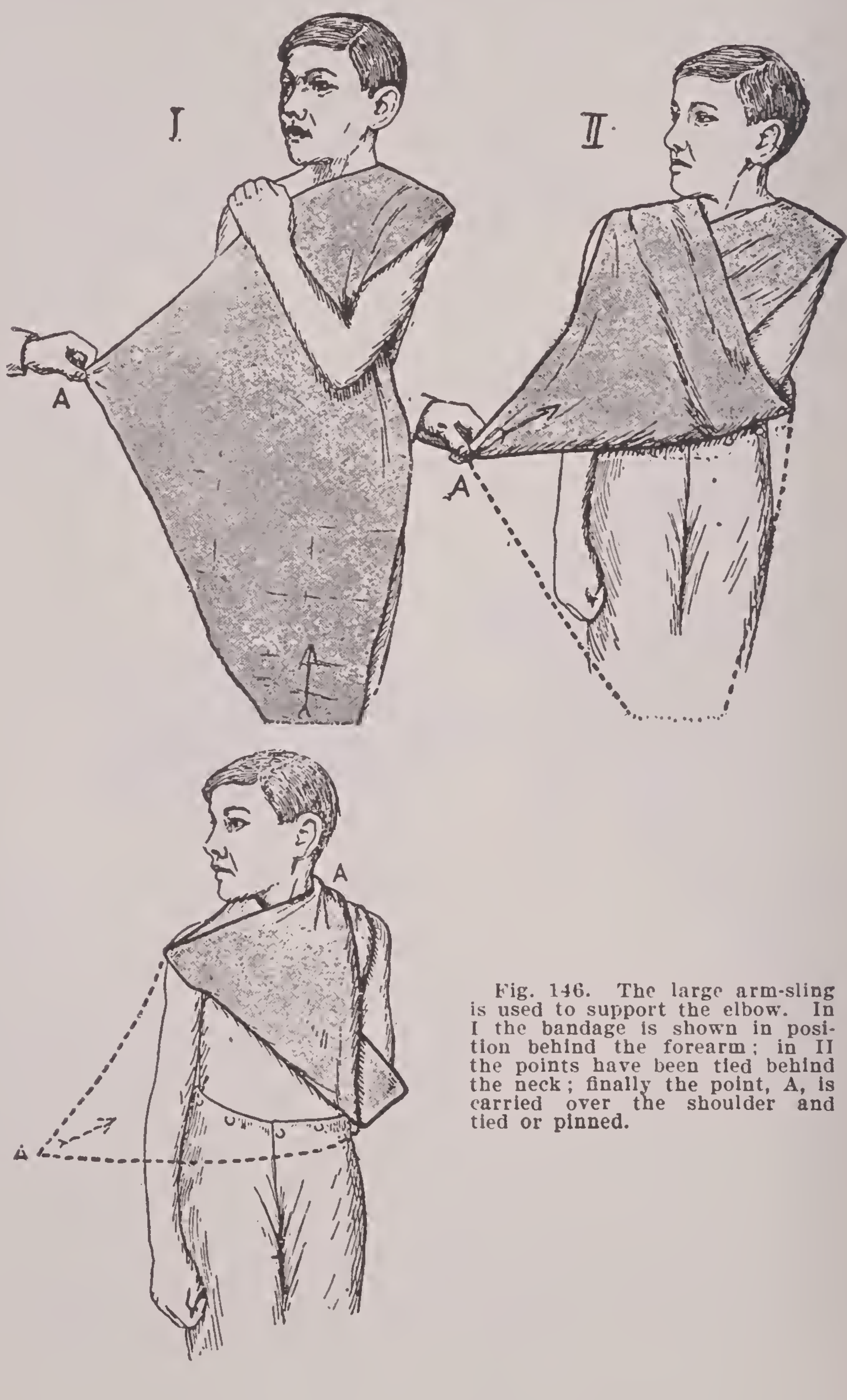


Fig. 146. The large arm-sling is used to support the elbow. In I the bandage is shown in position behind the forearm; in II the points have been tied behind the neck; finally the point, A, is carried over the shoulder and tied or pinned.

hand; place the forearm of the injured side across the front of the chest, with the fingers touching the opposite shoulder; draw the lower end over the elbow and across the front to the top of the shoulder of the sound side, and tie off with the upper end. Now take the apex, fold it well over the forearm, and pin to the bandage above on the injured side.

The Triangular Bandage for Wounds.—Before applying the triangular bandage, it is important in all cases to first apply an antiseptic dressing in the form of a pad to the wound.

1. **Wound of the Scalp.**—Fold the lower border of the bandage lengthways to form a hem 1½ inch wide; place the bandage with the middle of the hem just above the nose, and the point of the bandage hanging over the back of the head, to the neck; carry the two ends backwards above the ears, cross them behind at the nape of the neck (well below the occipital protuberance, or prominent part of the back of the head), bring them forward, and tie in front on the forehead. Then pull the apex down, so as to make the bandage fit well over the head; turn the point on to the top of the head, and pin it.

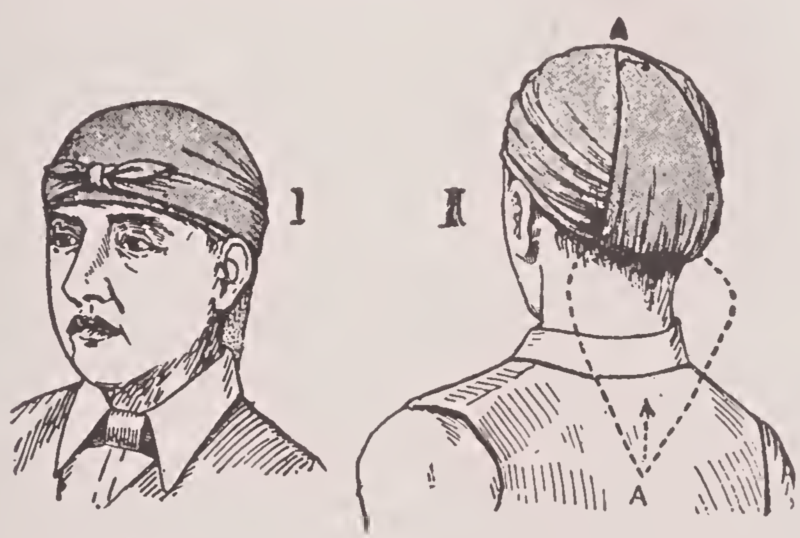


Fig. 147. The triangular bandage applied to the head. I shows the ends tied in front. II shows how the point is pinned up after it is carried to the top of the head in the direction of the arrow.

2. **Wounds of the Forehead or Back of the Head.**—Fold the bandage narrow, lay the center over the pad on the wound, carry the ends backwards, and tie on the opposite side of the head.

3. **Wounds of the Temple.**—Place the center of the bandage, folded narrow, on the opposite temple to the one wounded; bring the ends forward, and cross them over the pad placed on the wound. Now carry the ends respectively above the top of the head and below the jaw, and tie off on the sound temple, exactly opposite to the pad.

4. **Wounds of the Chin, Ears, or Side of the Face.**—Place the center of a narrow folded bandage under the chin, carry the points upwards, and tie off on top of the head.

Fig. 148. The triangular bandage folded narrow (cravat) and used to hold a dressing on the temple.

5. **Wounds of Both Eyes.**—Place the center of the bandage, folded broad, between the eyes; carry the ends backwards, cross, and tie off in front.

6. **Wound of One Eye.**—Place the center of the bandage, folded narrow, over the injured eye; pass one end obliquely upwards over the forehead and the other downwards across the ear; cross them below the occipital protuberance, and tie off above the eyebrow on the injured side.

7. **Wound of the Neck.**—Place the center of the bandage, folded narrow or broad, according to the size of the wound, on the pad; cross the ends, bring them back, and tie off over the wound.

8. **Wound of the Shoulder.**—Place the center of the bandage on the point of the shoulder, the point of the bandage well up on the side of the neck, and the lower border of the bandage on the middle of the upper arm; now carry the ends round the arm, cross them on the inner side, bring them forward, and tie off on the outside. Place the forearm on the injured side in a narrow arm sling; now pass the point of the bandage under the sling, fold it back on itself, and pin it on the top of the shoulder. Should the shoulder be so injured as not to be able to bear a sling, take a second bandage, folded narrow; place the center of it over the point of the first bandage; carry the ends downwards, and tie off under the armpit of the sound side.

9. **Wounds of the Chest.**—Apply the bandage, with its center at the middle of the chest, and the point over the shoulder of the injured side; carry the two ends round the chest, and tie at the opposite end.

leaving one end longer than the other; now draw the point well over the shoulder, and tie it to the longer end behind.

10. **Wound of the Back.**—Apply the bandage in a reverse way to 9.

11. **Wound (or Fracture) of Ribs.**—Take two bandages folded broad. Apply the middle of one over a pad placed on the wound, and the middle of the other just below it, and tie off the ends of both on the opposite side.

12. **Wound of the Abdomen.**—Apply the center of the bandage, folded broad, over the pad on the wound, and tie off on the side.

13. **Wound of the Upper Arm.**—Apply the middle of a bandage folded broad, to the center of the limb, carry the ends backwards, cross them behind, bring them back, and tie off in front. Then place the forearm on the wounded side in a narrow arm-sling.

14. **Wound of the Elbow.**—There are two ways:

a. Bend the elbow; then, after well turning in the lower border of the bandage, place the center of the bandage over the back of the elbow, with the point of the bandage upwards; pass the ends round the forearm, cross them in front, pass them round the upper arm, cross them behind, bring them forward, and tie off in front. Now tighten the bandage by drawing down point well, and pin off.

b. Apply a bandage, folded broad, about the elbow in the same manner as that for the upper arm.

In either case, after applying the bandage, sling the elbow with the large arm-sling.

15. **Wound of Forearm and Wrist.**—Apply the bandage, folded broad, in the same manner as for the upper arm, and place the forearm in a large arm-sling.

16. **Wound of Hand.**

a. **To Cover the Whole Hand.**—Spread out a bandage, lay the hand upon it with the wrist on the lower border, the palm downwards and the fingers towards the point; turn the point over the fingers, and carry it up on to the back of the wrist; pass the ends round the wrist, fixing the point, carry them back, and knot off over the point. Now draw the point over the knot and pin it down.

b. **For Injury to the Back of the Hand.**—Place the center of the bandage, folded narrow, over the pad on the wound, bring the ends round the hand, cross them on the palm, bring them over the back, cross them, then pass them back over the wrist, cross them in front, bring them back again over the wrist, and tie off.

c. **For a Wound in the Palm of the Hand.**—Place a stout pad to

well fill the palm of the hand, bend the fingers over the pad, place the center of the bandage, folded narrow, over the bent fingers, carry the ends up towards the wrist, cross them on the back, take two or three turns round the wrist, and tie off on the back.

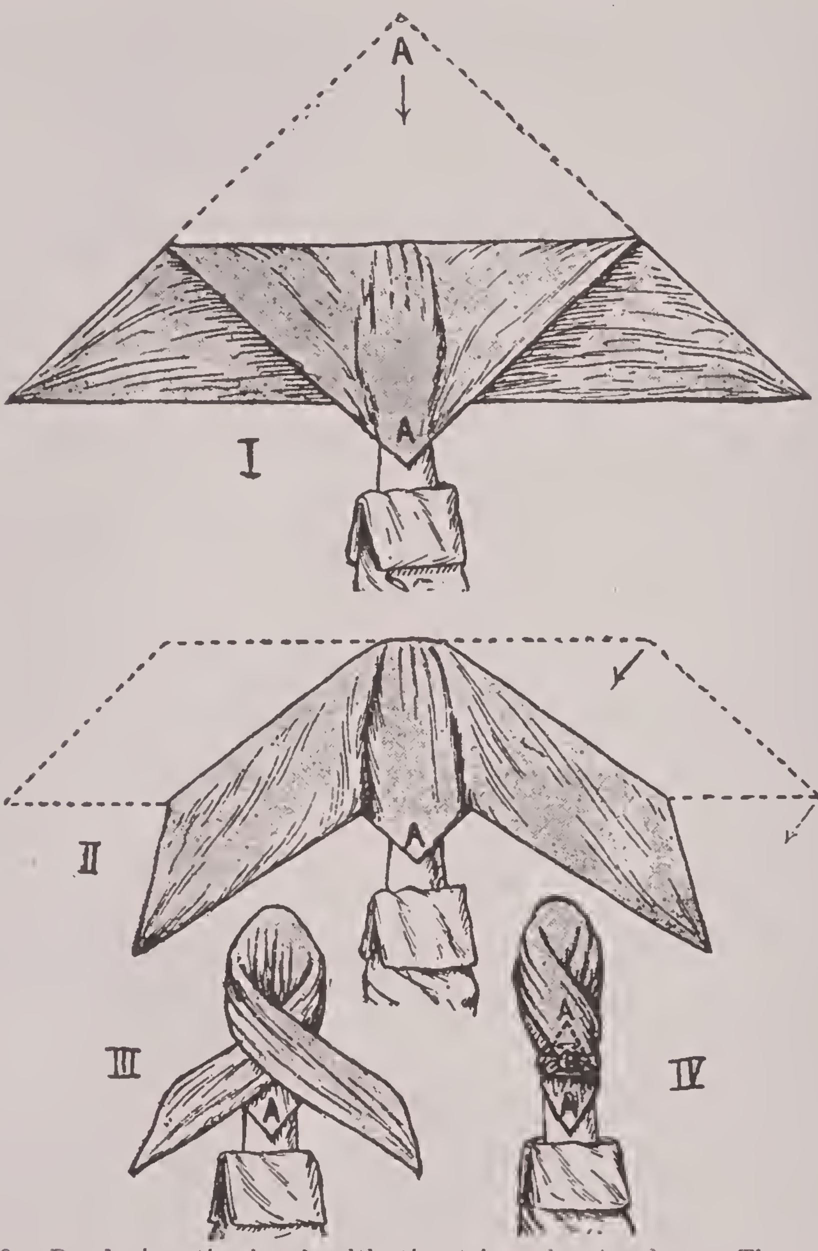


Fig. 149. Bandaging the hand with the triangular bandage. The arrows indicate the directions in which the corners are to be carried. The point, A, is finally turned down over the knot and pinned.

After the hand has been bandaged by any of the above methods, the elbow should be slung in the large arm-sling.

17. **Wound of the Hip.**—First tie one bandage, folded narrow like a waist-belt, round the body just above the hips with the knot on the side opposite to the injury, then apply the center of a second bandage on the wounded hip with the lower border well down on the

thigh, carry the ends backwards round the thigh, cross them, bring them forward, and tie them on the outside. Now pass the point under the narrow bandage, bring it forward, and pin it.

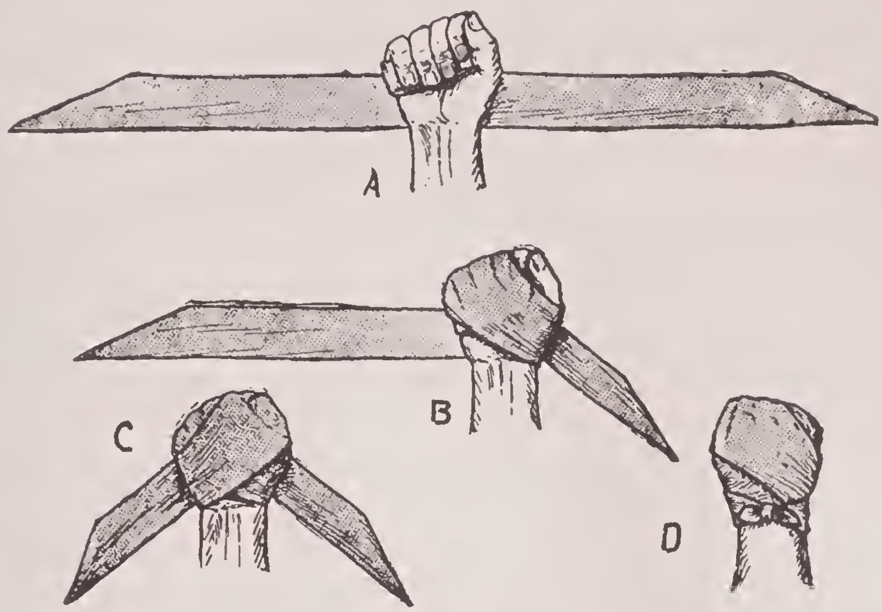
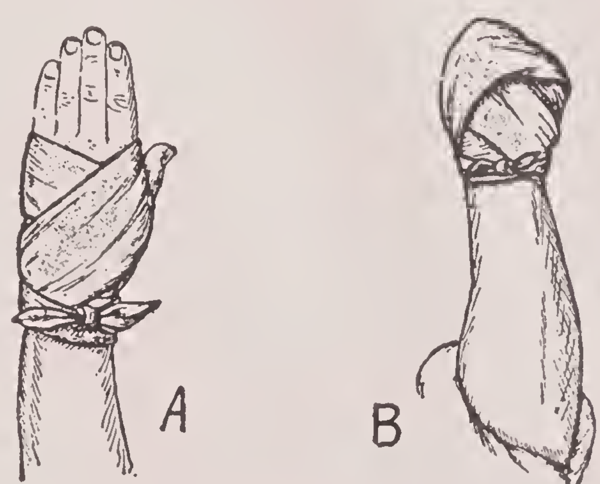


Fig. 150. The triangular bandage folded narrow (cravat), used to bandage the hand. A pad is placed in the palm to support the fingers and avoid cramping them.

Fig. 151. The knee with the triangular bandage applied to it. The point or apex, A, is to be turned down and pinned to B.



No. 152. Bandage for the hand. A, open, and B, closed.

18. **Wound of Thigh, Knee, or Leg.**—Here apply the bandage, folded broad, in the same manner as for the upper arm.

19. **Wound of Foot.**—Spread out a bandage, place the foot in its center with the toes towards the point, draw the point over the toes; take the ends, bring them forwards round the ankle to the front and over the point, cross them on the instep, carry them down under the sole of the foot, cross them, bring them up again, and knot them in front of the ankle. Now draw the point over the knot and pin it.

20. **Wound in Lower Part of Abdomen or in the Perinæum.**—There are two ways:

a. Take a triangular bandage, apply it with the lower border uppermost and the center of the bandage over the front of the lower part of the abdomen; pass the two ends backwards, and knot them off behind, leaving one end longer than the other. Now carry the point between the legs, draw it up well behind, and tie it to the longer end.

b. Tie one bandage, folded narrow, like a waist-belt; now take another bandage, also folded narrow, pass one end beneath the waist-bandage at the center of the back, fold it over and pin it; bring the other end forward between the thighs, pass it under the waist-bandage in front, and pin it.

21. **Wound in the Groin.**—Apply the center of the bandage, folded narrow, to the back of the thigh just below the buttock, bring the ends forwards, cross them over the groin, carry them back above the hips, cross them behind, bring them forward, and tie off in front.

22. **For a Limb Torn Off.**—Lay the bandage under the limb with the lower border upwards, turn the point well up over the stump, bring the ends forwards after crossing them behind, and tie off in front. Now draw the point over the knot and pin it.

The Triangular Bandage for Fractures.—1. **For Fracture of the Lower Jaw.**—There are two methods:

a. Apply the center of a bandage folded narrow to the point of the chin, carry the ends upwards, one on each side, pass one end over the top of the head till it meets the other end just above the ear, twist the two ends over each other, carry one in front of the forehead and the other behind the back of the head, and tie off above the opposite ear.

b. Take a bandage folded narrow, place the middle of it over the point of the chin, carry the two ends upwards, and tie them in a half-knot just behind the vertex. Now take a second bandage folded narrow, place the center of it under the lower lip, pass the ends backwards, tie them in a half-knot at the level of the occipital protuberance, then tie the two ends of the two bandages together behind.

2. **For Fracture of the Clavicle.**—See Fractures.

3. **To Secure Splints.**—The bandages must be folded broad when splints are to be fixed to the thigh or knee, and folded narrow when splints are to be fixed to the leg, ankle, forearm, or wrist.

Splints may be fixed in either of the following ways:

a. Apply the splint to the limb, raise the limb and steady it, place

the center of the bandage over the splint at the spot where it is to be fixed, pass the two ends round the limb, cross them inside, bring them forward, and tie off on the outside over the splint.

Fig. 153. Improvised splints and bandages to support a broken thigh whilst the patient is being taken home. Very great care is necessary in handling a person with a broken bone (especially in the case of the thigh), as the sharp ends of the broken parts cause great pain and are very liable to penetrate the skin and make the fracture compound, which is a much more dangerous thing than a simple fracture is.

b. **By the "Looped Triangular Bandage."**—Take a bandage folded narrow, double it upon itself, place the loop upon the splint on the outer side of the limb, pass the ends round the limb from without inwards. Now either pass one end through the loop, or the two ends through the loop, one from right to left and the other from left to right; tighten the bandage by steadily drawing in the two ends, and knot them.

The triangular bandage, to arrest bleeding, may be used as an improvised tourniquet, or in adopting the method of forced flexion (see Hæmorrhage).

2. The Roller Bandage and Its Application.

The roller bandage is essentially the bandage for use in all cases where it is required to maintain firm pressure—**e. g.**, in the control of bleeding, in the fixation of dressings after operations, etc. As the roller bandage requires considerable experience and skill for its proper application, it is not adapted as an emergency bandage for non-professional hands. Skill in its application may be gained by anyone who will practice its use.

The roller bandages may be divided into:

1. **Elastic Bandages.**—These are of several kinds—woven, india-rubber, etc. They are used to check the flow of blood when drawn tightly round a part, and to give support, as in varicose veins.

2. **Semi-elastic Bandages.**—These are made out of flannel, domette, silk, cotton-net, etc.; they lie more smoothly than those of the next group, and as, owing to their elasticity, reversing is unnecessary, they are easier to apply.

3. **Inelastic Bandages.**—These are made out of gray shirting,

unbleached or bleached calico or linen, and are the common roller bandages in general use. All selvage should be torn off.

The Sizes of the Roller Bandage are as follows:

Part.	Breadth.	Length.
For head	2 to 2½ inches	5 to 7 yards
" finger	¾ inch	1 to 2 "
" hand	1 "	4 to 5 "
" arm	1½ to 2½ inches	8 to 12 "
" shoulder	2½ "	8 to 12 "
" chest	3 to 4 "	6 to 8 "
" leg	2½ "	10 to 12 "
" foot	2½ "	4 "

To Roll the Bandage.—Proceed as follows:

Turn in enough of one end to start the roll; place the bandage upon the thigh, with the partial roll near the groin, and roll the cylinder, with the palm of the hand upon it, from above downwards. Special machines are in use for the purpose of rolling bandages.

The named parts of the bandage are: The face, or initial end; the rolled-up or terminal end; the body.

When a bandage is rolled up from one end only, it is termed a "single-headed" roller; when from both ends, a "double-headed" roller.

Points to be Observed in the Application of the Roller Bandage.—

1. Before applying the bandage, see that it is tightly rolled.
2. Stand in front of the limb to be bandaged, and place the limb in the exact position in which it is to be kept; i. e., in the upper limb, bend the elbow, placing the hand midway between pronation and supination (or place it thumb-side uppermost).
3. Commence the bandage by placing the outside of the bandage to the inside of the limb, and taking a couple of turns round the limb to fix it.
4. Always bandage from below upwards, except in the case of the trunk.
5. Always bandage from within outwards, over the front of the limb.
6. While bandaging, never unroll more than 2 or 3 inches of the bandage at a time.
7. Let each succeeding turn of the bandage overlap two-thirds of the preceding one.
8. Bandage the limb firmly, but never too tightly or too loosely.

On running the hand down a bandage, if the edges turn it is applied too loosely.

9. Use firm, equable pressure throughout the bandage. If when the bandage is removed red lines are seen on the skin, it indicates that unequal pressure has been applied.

10. In bandaging leave the **tips** of the fingers and toes uncovered, in order to see whether the bandage has been applied too tightly. If the tips become blue and cold, loosen the bandage.

11. Apply the bandage smoothly, leaving no wrinkles.

12. Keep all the margins parallel, and keep the crossings and reverses in a line and towards the outer side of the limb.

13. Never reverse a bandage over a sharp bone.

14. Always form a figure-of-eight at a joint.

15. Never apply a bandage wet; when dry, it will shrink and bind the limb too tightly.

16. End by fixing the bandage securely with a pin.

17. Never re-apply a bandage without first completely winding it up.

18. In taking off a bandage, gather the slack into a loose bundle, and pass it round and round like a ball.

The Roller Bandage May Be Applied in the Following Ways:

1. As a circular bandage.
2. As a spiral bandage.
3. As a reversed spiral bandage.
4. As an oblique bandage.
5. As a figure-of-eight bandage, and its modification, the spica.

1. **The Circular Bandage** consists of a series of turns made round and round a part (such as the head), each turn entirely overlapping the previous one.

2. **The Spiral Bandage** consists of a series of spiral turns, each one overlapping the preceding one by about two-thirds, and can only be applied to those parts which vary but slightly in their circumference, such as the forearm, just above the wrist, and the finger.

3. **The Reversed Spiral** consists of a series of spiral turns in which the bandage is turned over on itself while it is being applied, the object of turning the bandage being to make it lie smoothly and firmly over parts of the limbs which constantly vary in diameter, such as the forearm, the calf, etc.

In order to reverse, proceed as follows: Hold the head of the bandage lightly in one hand, place the thumb of the disengaged hand on the lower border of the bandage on the outer side of the limb,

slacken about 3 inches of the bandage, turn it over, reverse it downwards, pass it over the limb to the opposite side, keeping its lower edge parallel with that of the turn below; when the outer side of the limb is reached, make the reverse again, and so on.

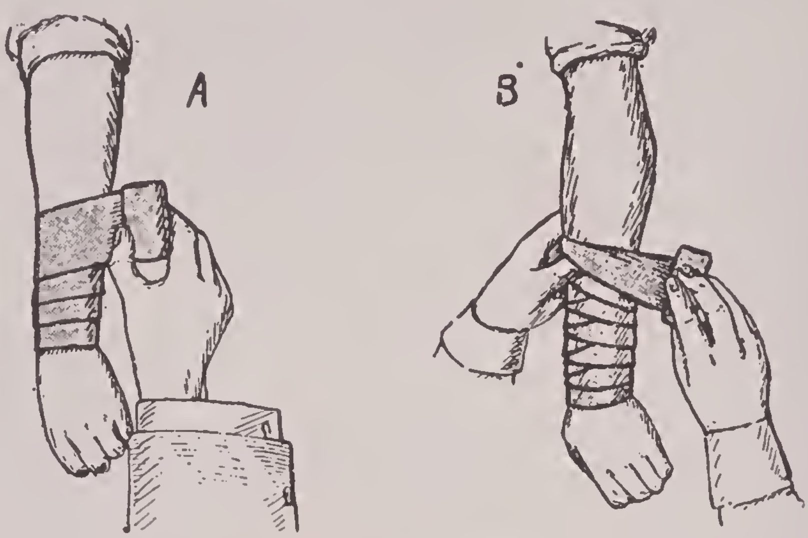


Fig. 154. A is the simple spiral bandage. In B the bandage is being applied as a reverse spiral. A is used as a loose retainer of a dressing, while B makes a firmer support.

This bandage is firmer than the simple spiral, and is to be preferred for fixing splints to a fractured limb. Its disadvantages are that it is somewhat liable to slip, and it is not elastic.

4. **The Oblique Bandage.**—This consists of a series of rapidly ascending spirals, which pass up the limb without their edges overlapping. It is used only for holding dressings loosely in their place.

Fig. 155. The Figure-of-eight over the wrist.

5. **The Figure-of-Eight Bandage.**—This consists of a series of loops forming a figure of eight, each figure overlapping the one below by about one-third the width of the bandage.

In order to apply the figure-of-eight bandage to the hand, proceed as follows:

Place the end of the bandage on the front of the wrist, bring it across the back of the hand and below the thumb and across the palm at the root of the fingers, then across the back of the wrist, then across the palm of the hand and across the back of the wrist over the first turn; repeat these movements (taking care that the loops overlap each other by about one-third the width of the bandage), as often as it is necessary, and finally fix the bandage with a circular turn round the wrist.

The figure-of-eight bandage is employed chiefly in the neighborhood of joints; it is less firm but more elastic than the reversed bandage.

The Spica Bandage.—This is a modification of the figure-of-eight bandage, having one loop very much longer than the other. It is used to retain dressings and to keep up pressure on a part.

There are two methods of employing the spica:

1. The ordinary spica, used at the junction of an arm or leg with the body.

2. The divergent spica, used to cover in large prominences, such as the heel, the bend of the knee, and the elbow.

Spica for the Groin.—This may be applied from below upwards, as the ascending spica, or from above downwards, as the descending spica.

(i) **The Ascending Spica.**—To apply it, proceed as follows:

Begin by making a circular turn round the upper fourth of the thigh on the side of the affected groin, then make reverses up the thigh till the groin is reached. Now carry the bandage across the front of the groin outwards and upwards to a little above the hip-joint, then across the small of the back and over the hip on the opposite side to the front of the abdomen, across the pubes, back again to the affected groin, then to the outside of the thigh, round the back of it to the outside and over the groin, and then again across the body, and so on, making each turn go a little higher, about ½ inch above the lower edge of the preceding turn, and finally fix with a pin.

(ii) **The Descending Spica.**—To apply it proceed as follows:

Lay the tail of the bandage over the affected groin, carry it over the pubes, across the abdomen, to the outer side of the other hip, then across the small of the back to the hip on the affected side, over the hip and across the front of the thigh to the inner side; then round

the thigh, back to the first turn, and so on, making each turn a little lower than the preceding.

Spica for the Shoulder.—This may be applied in two ways:
from within outwards round the upper third of the arm on the

(i) **From below upwards,** thus: Make a couple of circular turns affected side, to fix the bandage; then make reverses up the arm till the shoulder is reached; now carry the bandage behind the shoulder across the back to the opposite side, under the armpit on that side, then across the front of the chest, well up towards the tip of the breast-bone; then across the shoulder, in a line with the reverses upon the bandage on the arm; then below the shoulder, from behind forwards, to the front; and then across the back, and so on.

(ii) **From above downwards,** thus: After bringing up the bandage by means of reverses to the shoulder, carry the bandage over the front of the shoulder to the highest point; then round the back to the opposite side; then under the arm on that side, and then across the front of the chest and the front of the arm on the affected side; then under the armpit and over the shoulder again, but this time on a lower level than the preceding turn, and so on.

Spica for Breast.—To apply this proceed as follows:

Lay the tail of the bandage about 4 inches below the affected breast; now make two horizontal turns round the body, to fix the

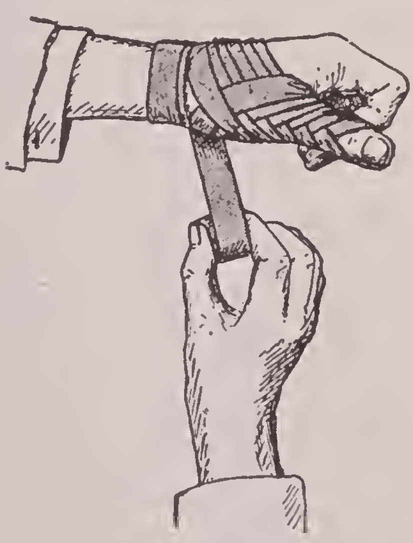


Fig. 156. The spica bandage applied to the thumb. The turns nearest the end of the thumb are made at the same time as those near the knuckles.

bandage; then carry the bandage under the affected breast, and over the opposite shoulder; then down the back, and again to the front, on a slightly higher level than the preceding turn; now horizontally across the body, and so on, till the whole breast is covered, each turn horizontal and oblique being on a little higher level than the preceding.

Spica for the Thumb.—This is the regular bandage for sprain of

the thumb and for hæmorrhage about the part. It is applied as follows:

Take a bandage not more than ¾ inch wide; place the palm of the hand downwards; now lay the tail of the bandage below the root of the thumb, and carry the bandage across to the back of and round the wrist twice, to fix it; now carry it upwards from the root of the thumb to between the thumb and forefinger; then round the thumb as high as it will lie; then across the back of the hand, and round the wrist again, back again to the root of the thumb; now again round the thumb, covering two-thirds of the former loop, back across the back of the hand, and so on, the loops round the thumb each time being a little nearer the wrist. Finally, fix the bandage round the wrist with a safety-pin, or by splitting the ends and tying.

Spica for the Great Toe.—This is applied in precisely the same way as the above, the ankle taking the place of the wrist.

Divergent Spica for the Heel.—To apply this proceed as follows:

Lay the tail of the bandage against the outer ankle, and carry the roller under the sole to the inner ankle, and from here within outwards, over the back of the foot, to the point where the bandage

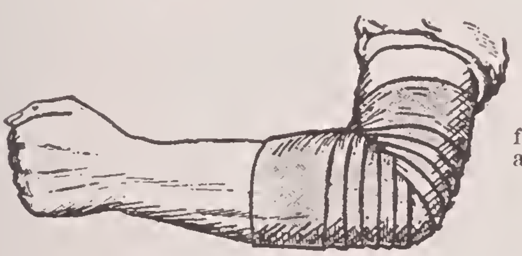


Fig. 157. The *divergent spica* for the elbow. This bandage allows the elbow to be moved.

started; now carry the bandage over the tip of the heel, placing the middle of the bandage over the most projecting part of the heel; then carry the bandage inwards, over the sole of the foot, then across the back of the foot, then below the point of the heel, catching the lower edge of the loop which goes over the heel; then again take the bandage over the instep, across the back, and now above the point of the heel, and over the upper loose edge of the loop which goes over the heel; back to the instep, and over the lower point of the heel again, and so on, each loop over the heel being a little further from the point than the preceding one.

Divergent Spica for the Elbow.—This is employed as follows:

Carry the roller up the forearm by means of reverses till the elbow is reached, then the elbow, and carry the middle of the bandage well over the point of it; now carry the bandage from within outwards, and catch the lower loose edge of the turn above: then take the bandage across to the inner side of the elbow, bring it from within

outwards again, and now catch the upper loose edge of the loop which encircles the point of the elbow. Continue these figures-of-eight, making each loop overlap from within outwards the preceding loop.

This bandage is employed when it is required to keep the arm in a bent position, as after fractures and injuries to the joint.

Divergent Spica for the Knee.—To apply this bandage proceed as follows:

Slightly bend the knee, lay the tail of the bandage against the inner side of the knee, carry the bandage over the front of the kneecap to the outer side of the knee, and back to the starting-point; then across the front of the knee, catching the lower loose margin of the turn above; then back to the starting-point, and again across the front of the knee, this time catching the upper loose margin of the first turn. Continue these figures-of-eight above and below alternately.

This bandage is used to give support to the knee-joint when it is inflamed.

To Apply a Roller Bandage to the Hand, Wrist, Forearm, Elbow, and Arm.—Proceed as follows:

Take a 2½ inch roller bandage. Make a couple of turns round the wrist, beginning at the root of the thumb, and passing outwards over the back of the wrist, then carry the bandage upwards and backwards over the back of the hand to the root of the little finger; now take one turn round the fingers, leaving the tips free, then make a figure-of-eight round the wrist and hand, and repeat this three or

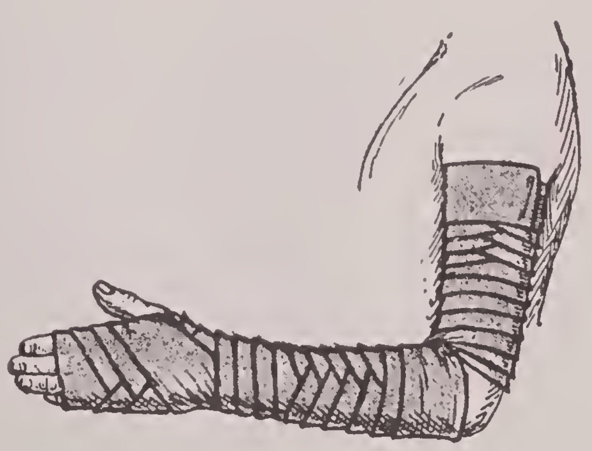


Fig. 158. The arm bandaged. Unless it is needed higher the bandage may stop below the elbow. The elbow is shown left "open" or uncovered.

four times; now make spiral turns round the forearm till the swell of the forearm is reached, then apply the reverse spiral till the bulging of the forearm begins to diminish; bend the elbow, making a figure-of-eight over it (leaving the point free, unless it is injured, in which case cover it), then make a few circular turns round the lower part

of the upper arm, and then begin to reverse till the armpit is reached, and secure the end with a safety-pin.

Note.—Never bandage the forearm and arm in a straight position, and then flex the elbow afterwards, as this will produce compression of the veins, and lead to swelling of the hand and forearm and subsequent mortification.

Finger Bandages.—The Continuous Finger Bandage.—To apply this bandage proceed as follows:

Take a bandage ¾ or, still better, 2-3 inch wide and 4 yards long. Make a turn round the wrist, leaving about 6 inches of the end free, take the bandage over the back of the hand to the inner side of the little finger, carry it down to the level of the nail, then make circular turns round the finger to the root, then from the thumb side of the root carry the bandage up the back of the hand, round the wrist, and again down the back of the hand to the ring-finger; now proceed successively with this and each of the other fingers till all are covered, and tie off the bandage by its loose end.

Fig. 159. How to bandage the leg. The bandage need not be continued above the knee if it is necessary only below the knee.

This bandage is used to prevent swelling when splints and dressings are applied to the forearm. It should always be applied before any other bandages are put on higher up. It is also of great use for burns or scalds of the fingers.

Any one finger may be bandaged in a similar manner to the above.

To Bandage the Lower Extremity.—Proceed as follows:

Take a 2½ to 3 inch roller bandage 6 to 8 yards long. Extend the leg, and place the foot at right angles to it; apply the free end of

the bandage over the inner ankle-bone, carry it across the instep to the root of the little toe, then across the foot to the ball of the great toe, bring it over the instep and the outer ankle-bone, round the back of the leg a few inches above the heel, overlap, and fix the commencement of the bandage; repeat this figure-of-eight once, and when the bandage again reaches the root of the little toe, make a spiral round the foot, then make two reverses over the lower part of the foot—these reverses being opposite the middle of the back of the foot—then make two turns of the figure-of-eight round the heel, then carry the bandage by three spiral turns round the ankle, and then by reverse spirals till the knee is reached; now make figures-of-eight over the knee-joint, either covering the point or leaving it free, then carry the bandage up the thigh by reverse spirals, and end with a spica of the groin.

Bandages for the Head.—1. The Capeline Bandage.—To apply this bandage proceed as follows:

Fasten two roller bandages together, one 2 inches wide and 4 yards long, and the other 1½ inch wide and 5 yards long. Make the patient sit down in a low chair, stand behind him with a roller in each hand, and place the middle of the bandage against the center of the forehead; now carry the rollers, one on each side, above the ears and below and behind the occiput, cross the wide roll over the narrow roll, transfer the wide roll to the right hand and the narrow roll to the left, and pull the bandage tight; now carry the small roll upwards along the middle of the head and down to the root of the nose. Bring the wide roll horizontally forwards above the right ear and across the narrow roll at the root of the nose, take the narrow roll back over the top of the head a little to the left of the middle line, fix it behind as in front by the wide roll, now bring it over to the front a little to the right of the middle line, again fix it by the wide roll; continue these operations backwards and forwards, each time making the bandage which is covering the top of the head diverge a little from the middle line till the ears are reached; cut off the vertical bandage in front, and fix by taking two extra turns with the horizontal bandage round the head, and pin in front.

This bandage is used to fix dressings on the head.

The disadvantages of it are that it is troublesome to apply, it is hot, and if it is applied at all tightly, it is apt to become painful.

2. **The Twisted or Knotted Bandage.**—To apply this proceed as follows:

Take a bandage about 2½ inches wide. Unroll the bandage for

about a foot, take the end in the right hand, place the bandage against the temple, carry the roll round the forehead and occiput, and bring it back to the unrolled end; now twist it round this end sharply, and carry the roller down below the chin and over the vertex till the unrolled end is reached, now twist it round this again and make a horizontal turn round the head, bring it back and repeat the vertical turn; repeat these turns till sufficient pressure is obtained, and then fix the bandage by knotting the two ends together.

This bandage is used to exert pressure on a graduated compress placed over a bleeding wound of the temple.

To Bandage the Chest.—Proceed as follows:

Take a roller 6 inches wide and 6 to 8 yards long, and apply it from below upwards in a simple spiral, making each spiral overlap the one below by about one-half its breadth. When the last spiral is completed, pin behind, leaving about 1½ yard free; bring this end over one shoulder, carry it obliquely across the bandage in front to its lowest edge, and fasten it by pins or stitches to all the underlying turns.

To Bandage the Abdomen.—Proceed in the same way, but bandage from above downwards, and fix by bringing the free end from behind forwards between the thighs.

3. Bandages of Special Form and Their Application.

1. **The Square Bandage.**—This is used as a protection for the entire head and neck, and is applied as follows:

Take a handkerchief a yard square, and so fold it as to allow the under layer to project about 4 inches beyond the upper, lay the middle of the bandage upon the top of the head, with the longer flap covering the eyes, the margin of the upper flap in a line with the eyebrows, and the short borders hanging upon the shoulders; take the two outer corners and tie them firmly under the chin, take the border of the under fold, turn it over the forehead, take its two corners, carry them round, and tie them in a reef knot behind the head.

2. **The Four-tailed Bandage.**—This bandage is used to keep a dressing on the chin, top, back or front of head, knee, etc., and for a broken jaw.

(1) **The Four-tailed Bandage for the Jaw.**—Take 1½ yard of a 3 inch roller, make a slit in the center of it about 3 inches long, and then slit down the ends to within 6 inches of the center, place the chin in the central slit, carry the two upper ends behind the neck and tie them, carry the two lower ends to the top of the head and tie them, then tie the four ends together behind the head.

(2) **Four-tailed Bandage for the Head** (the Four-tailed Cap).—Take a piece of calico 6 to 8 inches wide and 2 feet long, slit it up at the narrow ends for a considerable distance.

To apply it to the front of the head: Lay the bandage across the front part of the top of the head, carry the two anterior ends back behind the head and tie; carry the two posterior ends forward under the chin and tie.

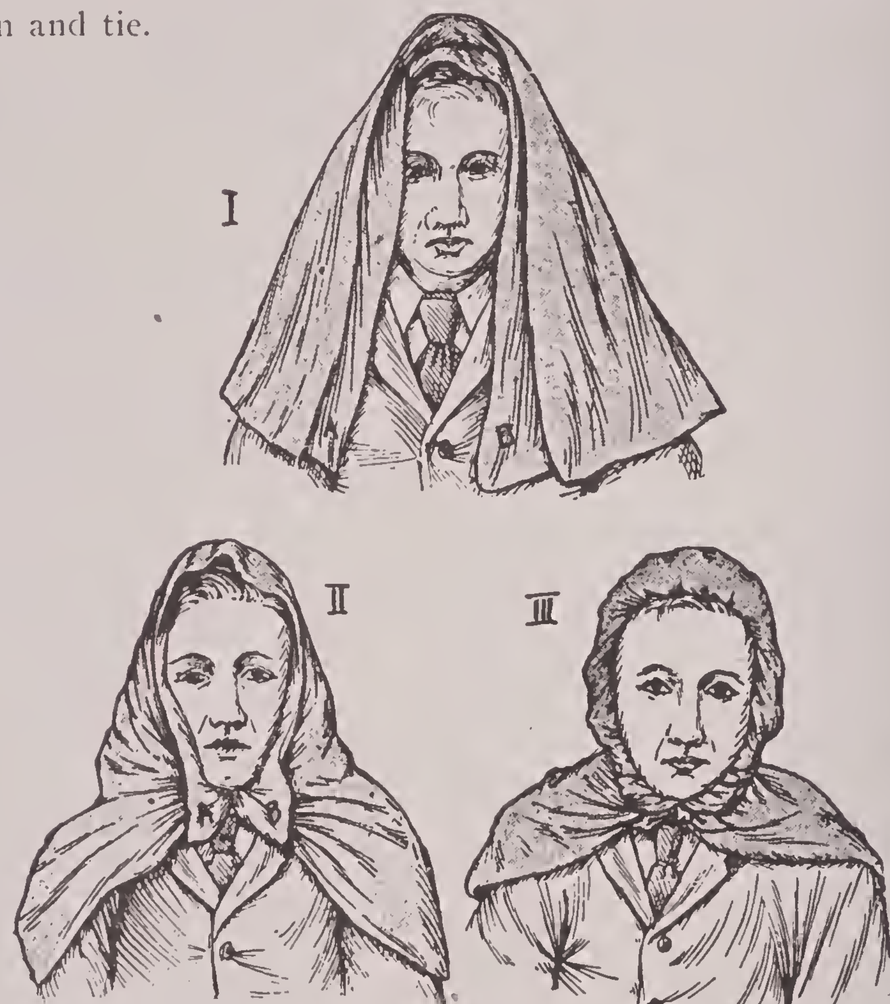


Fig. 160. How to cover the whole head with the square bandage. The corners A and B. seen in I and II, are carried around and tied behind, in III.

To apply it to the back of the head: Place the bandage across the back part of the top of the head, draw the two posterior ends forward, and tie them in front on the forehead; tie the two anterior ends under the chin.

(3) **Four-tailed Bandage for the Knee.**—Take a piece of calico 8 to 10 inches wide and 3 feet long, and slit it down at the narrow ends. To apply it, lay the center in front of the knee-cap, cross the ends behind, bring them forward, tie the two upper ones above the kneecap, and the two lower ones below.

3. **The Many-tailed Bandage** (Bandage of Scultetus).—This is

employed in cases where it is not advisable to disturb a part more than is necessary.

To make the bandage for a limb: Take a slip of bandage the same length as the limb it is required to cover, spread it out, lay strips across it 6 inches longer than itself, with their centers across the center of the perpendicular strip, and make these cross-strips overlay

Fig. 161. The four-tailed bandage applied to the top of the head.

Fig. 162. The four-tailed bandage as applied to the knee.

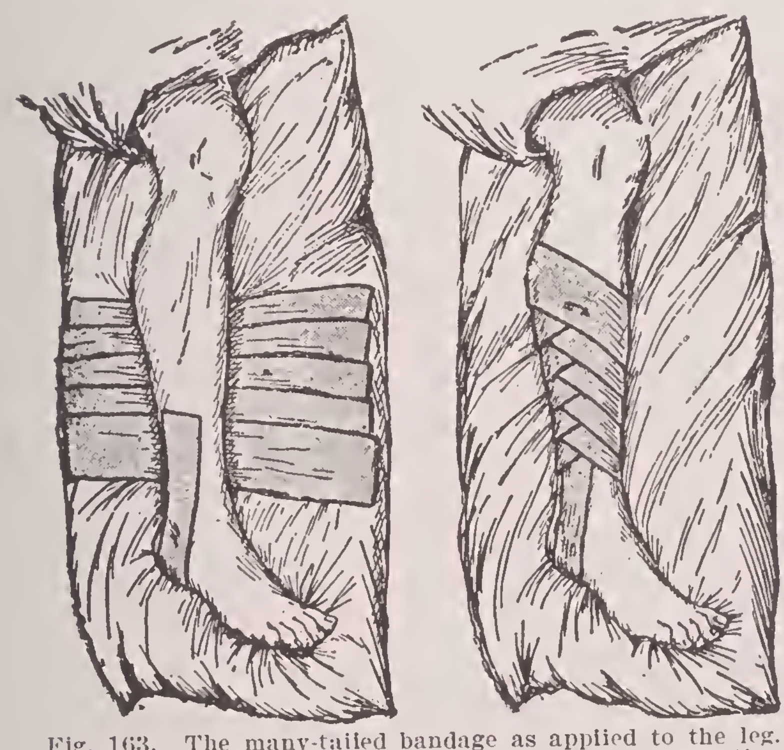
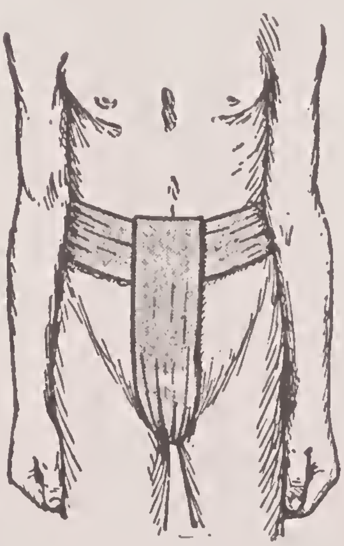


Fig. 163. The many-tailed bandage as applied to the leg. It can be undone without raising the leg off the supporting pillows.



The T bandage.

each other by about one-third their width; now sew all these bandages together.

To apply the bandage: Lay the limb along the central strip, and fold the strips over from below upwards, and secure the last two strips to the others by a pin on each side.

4. **The T Bandage.**—This bandage is used to retain dressings on the perinæum. It is made by taking a bandage 3 inches wide and 1½ yard long, and sewing this to a similar strip 1 yard long.

To apply it, pass the long strip round the hips, so that the short strip lies along the sacrum, and pin; now bring the short strip between the thighs, and pin to the other in front.

THE USE OF ROLLER BANDAGES.

Part to Be Bandaged.	*Kind of Bandage to Use.*	*Object of the Bandage.*
1. The Head	The Twisted or Knotted (Triangular very handy also)	Retain dressings, or for pressure on a pad over a bleeding wound
2. The Chest	The Spiral	Support, pressure, or hold dressings
3. The Breast	The Spica	Support or pressure
4. The Abdomen	The Spiral	To give support, exert pressure or retain dressings
5. The Thumb	The Spica	For sprain of the thumb, or to stop bleeding from the part
6. The Fingers	The Spiral, known as the Continuous Finger bandage	To retain dressings, especially in burns or scalds, or to prevent the fingers swelling when splints or dressings are applied to the forearm
7. The Hand	The Figure of 8	Retain dressings, fix splints, etc.
8. The Wrist	The Spiral	Ditto
9. The Forearm	The Reverse Spiral	Ditto
10. The Elbow		To keep the forearm bent, as in fractures, or in injuries about the elbow joint
(*a*) To cover the point	The Divergent Spica	
(*b*) To leave the point uncovered	The Figure of 8	To retain dressings or exert pressure
11. The Upper Arm		
(*a*) For the lower part	The Spiral	Retain dressings, fix splints, etc.
(*b*) For the upper part	The Reverse Spiral	Ditto
12. The Shoulder	The Spica	To retain dressings, or to exert pressure
13. The Great Toe	The Figure of 8	For sprains, or hæmorrhage from the part
14. The Foot	The Figure of 8 followed by the Spiral and the Reverse Spiral	To retain dressings, or exert pressure, or fix splints
15. The Heel		
(*a*) To cover the point	The Divergent Spica	Ditto
(*b*) To leave the point uncovered	The Figure of 8	Ditto
16. The Ankle	The Spiral	Ditto, or to fix splints
17. The Leg	The Reverse Spiral	Ditto
18. The Knee		
(*a*) To cover it in	The Divergent Spica	Support the knee when inflamed
(*b*) To leave it uncovered	The Figure of 8	To retain dressings
19. The Thigh	The Reverse Spiral	To retain dressings, or to fix splints
20. The Groin	The Spica	To retain dressings, or to exert pressure

Escape of Blood from the Heart or Bloodvessels

Subject Reference

For Surgical Treatment of Diseases and Injuries of Arteries and Veins, see Vol. 2, pages 80-88.

The Cause—Situation—Symptoms.
Varieties of External and Internal Hemorrhage.

How to Give Immediate Relief.

Definition.—Hemorrhage, or bleeding, is the escape of blood from the heart or the bloodvessels.

The Causes of Hemorrhage.—Injury or disease.

Situation.—Hemorrhage may be either (1) **external**—this is more frequently the result of injury; or (2) **internal**—this is due more often to disease affecting the bloodvessels or their neighboring structures; it may be due to injury.

The Symptoms of Hemorrhage are the **actual appearance of blood** (always seen in external hemorrhage, and sometimes in internal hemorrhage, e. g., in bleeding from the lungs, etc.), and the **constitutional effects,** more or less severe, which follow the loss (i. e., the signs of syncope or fainting), and which are indicated by a cold and clammy skin, a pallid and livid face, dilated pupils, feeble and irregular breathing, an irregular and almost imperceptible pulse, dizziness, inclination to vomit, and loss of consciousness. These constitutional effects are in direct proportion to the suddenness of the loss of blood; i. e., the quicker the loss, the more profound the syncope.

Varieties of Hemorrhage.—Hemorrhage may be:

1. **Capillary.**—This, which is the least dangerous variety, is a general oozing from the whole surface of the wound, the color of the blood being more or less a brick-red.

2. **Venous.**—This is indicated by the blood flowing in a continuous stream and coming chiefly from the side of the wound furthest from the heart (e. g., from the lower side of a wound of a limb), the color of the blood being a dark purple.

Venous hemorrhage comes next in seriousness to arterial.

3. **Arterial.**—This, which is the most serious form of bleeding, is indicated by the blood flowing in a forcible, jerky stream (which rises with every beat of the heart and falls in the interval) from the side of

the wound nearest the heart (e. g., from the upper side of a limb wound), the color of the blood being a bright red.

External Hemorrhage.

The Treatment of Capillary Hemorrhage.—The bleeding part should be exposed to the air, which hastens clotting, and pressure applied to it, either by means of perfectly clean fingers or a piece of clean sponge or lint which has, if possible, previously been well dipped in some antiseptic solution.

If either of the above methods fail, some styptic (such as clean cold water, hot water at a temperature of 110° to 120° Fahr., burnt or dried alum, tincture of steel, turpentine, common salt, tannic or gallic acid, nitrate of silver, etc.) must be applied to the wound.

Caution.—In the employment of styptics care must be taken that they are not of such strength as to destroy the living tissues to which they are applied.

The Treatment of Venous Hemorrhage.—In treating bleeding from veins, the following measures are necessary:

1. Remove all constrictions which impede the return flow of blood to the heart; i. e., all tight clothing about the neck and chest must be removed, garters undone, etc.

2. Elevate the bleeding part above the level of the heart; therefore, if the bleeding is from a limb, raise it.

3. Apply digital pressure (pressure with the fingers) **directly** to the surface of the wound, and as soon as possible supersede this by an antiseptic pad and bandage.

The Treatment of a Burst Varicose Vein.—The superficial veins of the lower extremities are liable to become dilated, or varicose, from the pressure of the column of blood on their walls, and the insufficiency of their valves, and may burst, leading to rapid and serious, or even fatal, hemorrhage if not promptly attended to. The measures for a condition of this description are as follows:

1. Place the patient on his back.
2. Raise the bleeding leg.
3. Remove all constrictions on the limb above the bleeding place.
4. Place an antiseptic pad directly on the wound, and fix it with a roller bandage carried from the root of the toes to about a hand's breadth above the seat of the hemorrhage.

The Treatment of Arterial Hemorrhage.—In treating arterial hemorrhage the following points need attention:

5. Keep the patient lying down, with the leg slightly elevated for some hours after the accident.

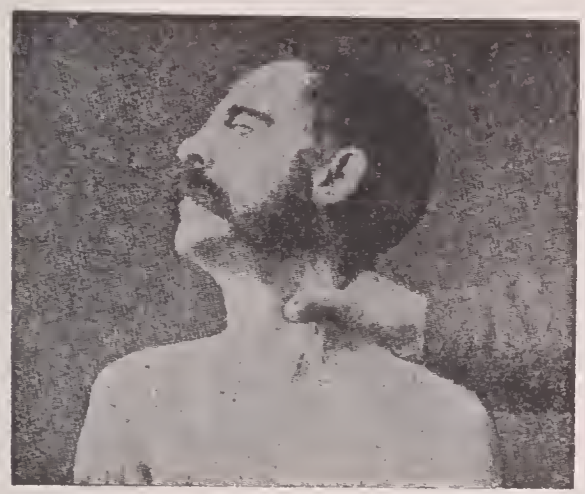


Fig. 164. Compression of the *carotid* artery to stop bleeding from any place higher.

6. If the bleeding has been excessive, keep the patient perfectly warm, to counteract the effect of any sudden weakening of the heart's action.

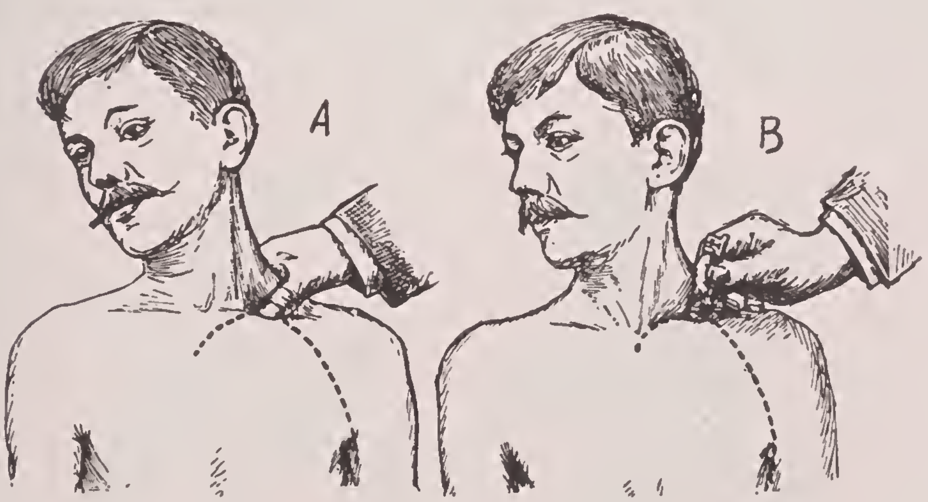


Fig 165. Where and how to compress the subclavian artery by pressing it against the first rib behind the collar bone. In A the thumb is used; in B the padded handle of a key (or other suitable object) is used if the patient is muscular or fleshy and if the thumb is not successful.

1. The **proper position** of the bleeding part. In all cases the first thing to do is to **expose the wound** and place the wounded part, if possible, **above the level of the heart,** i. e., elevate it.

2. The application of **pressure** to stop the bleeding.

3. The **treatment of the constitutional symptoms** (if any) which result from the loss of blood.

4. Constriction or pressure must be gradually lessened after the bleeding has been arrested for ten or twenty minutes. If the bleeding starts afresh renew the pressure.

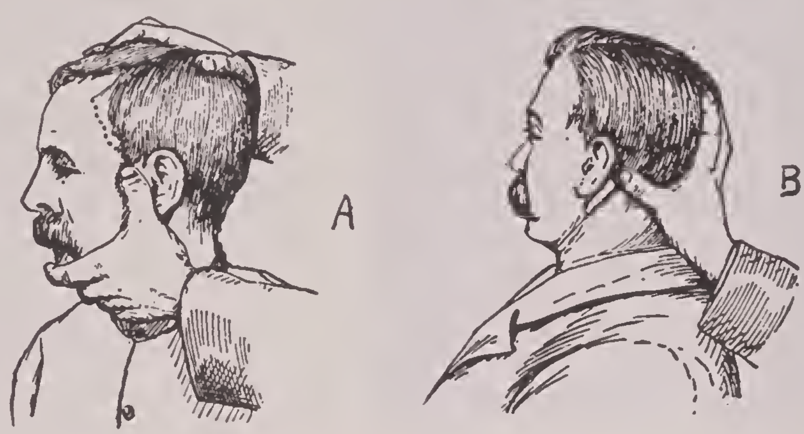


Fig. 166. A shows how to stop bleeding of the scalp above or in front of the ear, by pressure on the temporal artery. B shows where to apply pressure (on the occipital artery) to stop bleeding of a wound on the back of the head.

"First Aid" Methods of Controlling Arterial Hemorrhage.—The measures to be adopted will depend upon the severity of the bleeding.

a. If the bleeding is not excessive, e. g., in all superficial hemorrhages, apply:

Fig. 167. In A is shown how to compress the facial artery to stop bleeding from a wound in the cheek or lips or skin on the nose. In B is shown how to compress the carotid artery, by pressing it firmly backward with the thumb against the "carotid tubercle"—a bony projection from the 6th vertebra of the neck.

(i) **Firm pressure** directly to the bleeding-point by means of absolutely clean fingers, and when the bleeding has quite stopped, place

(ii) **An antiseptic pad** over the wound, and retain it in position either by means of a folded triangular bandage or a roller bandage. In some situations, e. g., the palm of the hand, a graduated compress (made by superimposing several layers of antiseptic lint upon each

Fig. 168. Compressing the artery in the arm to stop bleeding at any lower part of the arm.

other, the smallest being about the size of a dime, and the largest that of a quarter) is more effectual than a simple pad.

b. If the bleeding is excessive, apply:

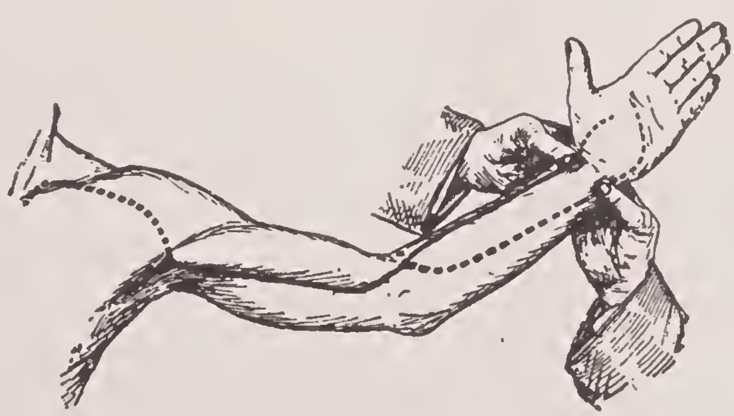


Fig. 169. How and where to apply pressure to the arteries in the front of the wrist in order to stop bleeding from a wound in the palm or fingers. It is usually necessary to press on both the arteries. The lines show the course of the main arteries of the arm.

(i) **Digital compression** (compression by means of the fingers), if possible, to the main artery supplying the part with blood. This pressure must be applied to the artery between the wound and the

heart, and at a point where some hard basis of support is furnished against which the artery can be pressed, e. g., where the vessel passes over or along the side of a bone. The value of digital compression is that it can be applied **immediately.**

The following points are to be remembered in applying digital compression:

1. Use the thumb to make the pressure.

2. Get the artery firmly against the bone, and press directly upon it.

3. Compress the artery only, avoiding all adjacent structures, such as nerves and veins.

4. Remember that digital compression is only applicable in certain parts, as the limbs, the neck, and some parts of the head and face; and that it cannot be maintained effectively by one person for more than fifteen consecutive minutes at a time. The pressure exerted by the thumb may be supplemented by pressing on it with the other hand or with the elbow.

Fig. 170. The application of a pad on the artery in the arm, to stop bleeding at any point lower. A bandage is firmly bound over the pad to press it on the artery.

(ii) Supersede digital compression by means of a **hard pad** placed on the main artery, and retained in position by a bandage.

In the case of arterial bleeding from the **limbs,** digital compression can be superseded by the following:

c. **Compression by forced flexion,** or by the application of pressure to the main artery by bending it acutely at the point where it passes over a joint. The main artery always lies on the side of the joint towards which the latter bends, i. e., in the hollow of the joint.

The points where this method can be used are in the **armpit,** the **bend of the elbow, bend of the groin,** and the **bend of the knee.**

Mode of Procedure.—Fix a hard pad in the bend of the joint which is next above the bleeding-point by means of a triangular bandage folded narrow, bend the limb over the pad, and bandage it to the part above.

d. **The constriction of the whole limb** above the bleeding-point: by a narrow-folded triangular bandage tied loosely in a knot round the limb; a stick is then inserted into the loop, and twisted round several times to make the loop tight.

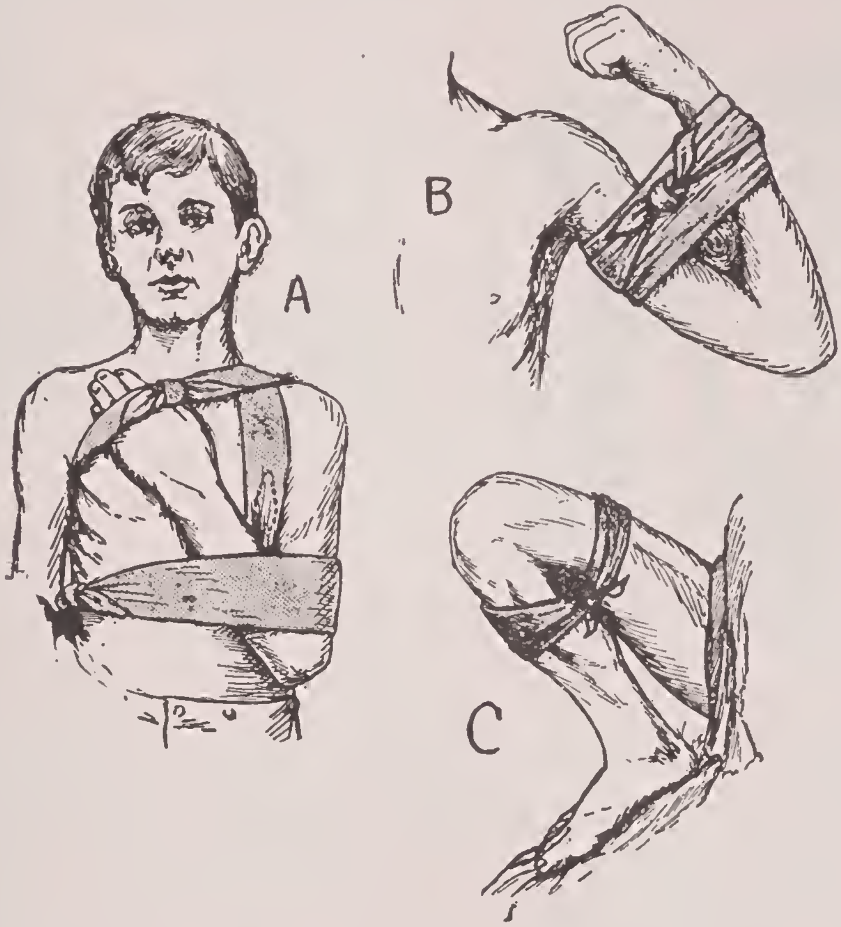


Fig. 171. A shows how to compress the axillary artery (in the armpit), by placing a pad in the armpit and then binding the elbow to the side. This will stop serious bleeding at any place between the shoulder and the elbow, or in the armpit. B shows how to stop bleeding at any part below the elbow. A pad is placed in the hollow of the elbow and the elbow is then firmly flexed and held so by the bandage. In C is shown how to stop bleeding below the knee. The pad should be firm and should fit neatly into the hollow behind the knee.

The disadvantage of the above method (d) is that the complete arrest of the blood-supply to the parts below the constriction favors the tendency to mortification of the limb; hence it is preferable to employ

e. **Tourniquets,** which are instruments constructed on the principle of a strap to encircle the limb, a pad to place on the blood-vessel, and a screw, buckle, or other means to tighten the strap. A handkerchief folded, a man's braces, or a garter will do to encircle the part.

The advantage of tourniquets is that effectual pressure is applied to the main artery, without undue constriction of the whole limb.

The kinds of tourniquets most suitable are:

1. **The Improvised Tourniquet, or "Garrot."**—This is made by folding a handkerchief like a cravat, and placing some hard substance in its folds, to act as a pad. The pad is placed over the vessel, the

Fig. 172. Compressing the large artery of the leg to stop bleeding at any place lower down. The same method will stop the bleeding from ruptured varicose veins of the leg.

handkerchief is loosely knotted, a stick is passed between the knot and the limb; a soft pad is now placed between the stick and the man's limb, and the stick is twisted round several times, till the vessel is compressed, and then tied to the limb to fix it.

2. **Volker's Stick Tourniquet.**—This can be applied only to the arm, and is made by taking two sticks 6 to 8 inches long, ¾ inch thick, and notched at their ends. One stick is placed on the artery, and the other on the opposite side to it, and the two are then tied together at their ends.

The Treatment of Constitutional Symptoms.—In order to counteract syncope (or fainting) due to the loss of blood, the patient must be kept at absolute rest, in a recumbent position, with the feet slightly raised. His clothes should be removed; his body should be wrapped round with warm blankets, and hot-water bottles should be applied to his feet. If able to swallow, stimulants are to be given in small quantities, but only after the hemorrhage has entirely stopped. If the loss of blood has been very excessive, the breathing may be very much embarrassed, or it may actually stop. Here artificial respiration must be performed.

Treatment of Hemorrhage by Compression of the Principal Arteries of the Body.

Part wounded.	*Artery to compress.*	*Course of Artery.* (See Figures.)	*Spot to apply Pressure.*	*Direction of Pressure.*	*Kind of Pressure employed.*	*Treatment to be adopted after Hemorrhage has stopped.*
1. Temple, front or top of head.	Temporal.	Passes over the zygoma, or bony ridges in front of the ear.	One finger's breadth in front of opening of ear.	Directly against the bone.	Digital, superseded by pad on artery, retained in position by a twisted triangular or knotted roller bandage.	Dress the wound.
2. Face below the eyes.	Facial.	Passes over lower jaw.	One inch in front of angle of jaw.	Ditto.	Digital, superseded by a pad on artery retained in position by a narrow fold triangular bandage.	Ditto.
3. Back of head.	Occipital.	Passes over the mastoid process.	Two fingers' breadth from center of back of ear.	Ditto.	Ditto.	Ditto.
4. Neck.	Common carotid.	Passes along side of neck from a point midway between angle of jaw and mastoid process to sternal end of clavicle.	One and a half inch above the sterno-clavicular joint.	Inwards and backwards against the transverse process of the sixth cervical vertebra.	Digital compression.	When the bleeding has completely stopped, dress the wound, bend the head forward towards the chest, and fix it there by bandages and pillows.
5. Shoulder or axilla.	Subclavian.	Passes over upper surface of first rib.	Behind middle of clavicle.	Downwards and backwards against the first rib.	Digital, superseded by the padded handle of a door key.	Dress the wound, apply a spica bandage to shoulder to retain the dressings and place forearm in a large arm-sling.

Treatment of Hemorrhage by Compression of the Principal Arteries of the Body.

Part wounded.	*Artery to compress.*	*Course of Artery.*	*Spot to apply Pressure.*	*Direction of Pressure.*	*Kind of Pressure employed.*	*Treatment to be adopted after Hemorrhage has stopped.*
6. Upper third of arm.	Axillary.	Passes over apex and along outer-side of axilla or armpit.	At the junction of the outer with the middle third of the ampit.	Outwards and a little backwards against the humerus.	Digital.	Ditto.
7. Lower two-thirds of arm.	Brachial.	At the inner border of the biceps muscle in a line with the inner seam of the coat.	Middle of arm.	Outwards and backwards against the humerus.	Digital, superseded either by Völker's stick tourniquet or by forced flexion; *i. e.*, firm pad in axilla, and arm bandaged to side of chest, or by Esmarch's band, or a tourniquet ("improvised," screw or field).	Dress the wound, and place forearm in a large arm-sling.
8. Forearm.	Brachial.	Under inner edge of tendon of biceps muscle.	At bend of elbow.	Downwards and backwards against the humerus.	Forced flexion at bend of elbow, or by any of the methods for No. 7.	Dress the wound, and sling the elbow.
9. Palm of hand.	Radial and Ulnar.	Along outer border of wrist. Along inner border of wrist.	One inch above wrist. Ditto.	Directly backwards against the radius and ulna.	Digital, superseded by any of the methods for No. 7.	After dressing the wound, place a hard pad in the palm, flex the fingers over it, bandage and sling the elbow, with the injured hand resting against the opposite shoulder.

10. Upper third of thigh.	The common femoral.	Passes through the bend of the hip.	At bend of groin midway between the middle line of the body and iliac spine (or front of the hip-bone).	Directly downwards against the pubes.	Digital, or forced flexion, with a hard pad on the artery.	Dress the wound, fix the pad on artery and dressings on wound with a spica bandage to the groin, then apply a long splint to outer side of the injured limb, and keep the patient in a recumbent position, with the foot slightly raised.
11. Lower two-thirds of the thigh.	Superficial femoral.	Passes along a line drawn from middle of bend of groin to inner side of knee.	Middle of thigh.	Outwards against the femur.	Digital, superseded by Esmarch's band or a tourniquet ("improvised," field, or screw).	Dress the wound, and apply a long splint to outer side of the injured limb, and keep patient in a recumbent position, with the foot slightly raised.
12. The leg.	Popliteal.	Along the middle of the ham.	In the center of the middle of the ham.	Directly against the posterior surface of the lower end of the femur.	Forced flexion at bend of knee, superseded by any of the methods for No. 11.	Ditto.
13. The foot.	Posterior	Below internal malleolus (inner ankle).	A thumb's breadth from the internal malleolus.	Forwards and outwards against the tibia.	By a pad placed on each vessel, and a bandage tied round limb to retain the pads in position.	Dress the wound, and keep the foot slightly raised.
	and					
	Anterior tibial.	Middle of front of ankle.	Midway between the two malleoli.	Backwards against the tibia.		

Internal Hemorrhage.

The Causes of Internal Hemorrhage.—(1) **Injury,** due to blows on the trunk, stab wounds, severe crushes, falls from a height, etc., causing bruising and laceration of internal organs. (2) **Disease,** producing the bursting of a bloodvessel.

The blood may escape into one of the closed cavities of the body, such as the abdomen, cranium, or thorax; or it may make its escape to the outside through an opening in the cavity, artificial or natural.

Serious hemorrhage into a closed cavity is denoted by the nature of the accident, and the signs of syncope or fainting which follow it.

The **Measures** to be adopted are:

To send at once for medical assistance, and in the meanwhile to treat the constitutional symptoms due to the loss of blood.

When blood makes its escape through one of the natural openings of the body, it may take the form of:

1. Blood-spitting.
2. Blood-vomiting.
3. Nose-bleeding.
4. Bloody stools.

1. **Blood-spitting.**—This may proceed from:

(a) The **mucous membrane of the mouth,** especially the gums, or from the cavity left after the extraction of a tooth.

Treatment.—If the bleeding is slight, wash the mouth out with hot water as hot as it can be borne, or with a solution of alum, or a strong solution of salt and water, or give pieces of ice to suck. The alum or salt solution may be held in the mouth.

If the bleeding is from the socket of a tooth, plug it well with a pledget of cotton-wool dipped in a solution of salt and water. If the bleeding is severe, apply pressure directly to the bleeding-point by means of a small pad. The patient must avoid suction of the tooth-socket.

(b) The **throat,** due to injury to the windpipe or to the gullet.

Treatment.—Keep the patient quiet in a lying-down position, and give him small pieces of ice at frequent intervals to suck.

(c) The **back part of the mucous membrane of the nose.**

Treatment.—See Bleeding from the Nose.

(d) **Bleeding from the Lungs** (Hæmoptysis).—This is indicated by scarlet and frothy blood being coughed up in mouthfuls, and is usually the result of disease of the lungs or of injury to the ribs.

Treatment.—(i) Send at once for medical assistance, stating ex-

actly the condition from which the patient is suffering. In the meanwhile,

(ii) Lay the patient down, with his head and shoulders raised on a pillow; keep him absolutely quiet, and do not let him talk or make the slightest exertion.

(iii) Admit plenty of fresh cool air to the room by opening the windows.

(iv) Give the patient ice to suck, or let him sip cold water, or vinegar and cold water, or a strong solution of alum and water, or a strong solution of cold tea with a lump of ice in it.

If the faintness due to the loss of blood is severe, be cautious in the employment of stimulants, but apply, in conjunction with the above methods, smelling salts to the nostrils and warmth to the feet.

2. **Blood-vomiting** (Hæmatemesis).—This is usually caused by disease affecting the walls of the stomach. It may be due to blood swallowed from the nose or throat, and not seen until vomited.

Its occurrence is preceded by faintness, with a feeling of weight at the pit of the stomach, paleness of the face, and a feeble pulse.

The blood vomited is dark in color, sometimes coagulated and mixed with food, and looking more or less like "coffee grounds."

Treatment.—The same as that for bleeding from the lungs is to be adopted.

3. **Bleeding from the Nose** (Epistaxis).—This may be due to injury to the nose or it may be a sign of disease, or be the result of constitutional disturbance.

Treatment.—If severe, send at once for medical assistance, and take care that the doctor is made acquainted with the nature of the case. In the meanwhile, undo all the tight clothing around the neck, and make the patient sit down on a chair or sofa with his head slightly thrown back (never allow him to hang his head over a basin), open the window, raise the arms, stretched to their full extent, well above and behind the head, apply a cold wet sponge or towel, or a lump of ice, to the back of the neck between the shoulder blades, also apply cold to the root of the nose. If the bleeding does not stop, syringe the nose with cold water, or a solution of alum—one teaspoonful to a pint of water—or cold tea. Pinch the nose just below the bridge between the thumb and forefinger, and take a piece of soft rag, wrap it up tightly, and push it into the bleeding nostril. A wad of paper or a coin behind the upper lip and the mouth kept tight shut often stops nose bleed. The patient should try to breathe gently through the nose as the air favors clotting. The clot should not be disturbed until some time after the bleeding has stopped.

Subject Reference

For Wounds Requiring Surgical Treatment, see Vol. 2, pages 71 to 80.

For Hydrophobia and Other Infection, see Vol. 2, pages 34-59.

Simple and Poisoned Wounds

Including Poisonous Stings of Insects, Snake Bites, Dog Bites, Etc.

Their Definition and Treatment.

Simple Wounds.

Simple Wounds.—These present the following varieties:

1. **Incised or Clean-cut Wounds**—wounds produced by sharp-edged instruments, with cleanly divided edges and more or less free bleeding.
2. **Contused or Bruised Wounds**—wounds produced by means of blunt instruments, causing bruising of the parts, with little or no external bleeding, but subsequent discoloration of the surrounding parts.
3. **Punctured or Stab Wounds**—wounds produced by sharp-pointed instruments or objects, very often resulting in considerable bleeding and deep internal injuries.
4. **Lacerated Wounds**—wounds caused by tears from machinery or by blows from or falls on sharp stones, bricks, glass, etc., or by bites of animals, with ragged, torn edges and very little bleeding.

In the **Immediate Treatment** of wounds the following points must be borne in mind:

1. To cleanse the wound and keep it clean.
2. To arrest the bleeding.
3. To keep the wounded parts at rest.
4. To protect the wound by some dressing material.
5. To treat any constitutional symptoms, such as shock, that may arise.

Cleansing the Wound and Keeping it Clean.—In order to cleanse the wound and keep it clean, the following points are to be remembered:

1. Not to touch the wound with dirty hands or dirty instruments. There is no excuse for putting more dirt into a wound, even if it is already dirty.
2. Not to wash the wound with water from any source unless it has been boiled or contains some good antiseptic.

Therefore proceed as follows:

Before touching the wound, first **wash the hands well** with warm water, soap and nail-brush, and then rub them with turpentine, or thoroughly rinse them in a carbolic solution (1 in 100). Then, to cleanse the wound and free it from dirt, etc., wash the wound thoroughly with an antiseptic solution, such as a lotion of carbolic acid (1 in 60 or 1 in 100) or perchloride of mercury (1 in 1,000 to 1 in 2,000). If the above lotions are not at hand, or cannot be readily procured, any of the following may be used:

1. Alcohol, in the form of whisky or methylated spirit, with an equal bulk of water.
2. Turpentine.
3. Acetic acid, in the form of vinegar, diluted with an equal quantity of warm water.
4. Condy's fluid—two teaspoonfuls of permanganate of potash to a pint of warm water.
5. Common salt—a dessertspoonful dissolved in a tumbler of warm water.
6. Water which has been well boiled and allowed to get sufficiently cool.

In washing the wound be careful in detaching any blood clots which have formed in it, for fear renewed bleeding may ensue. Bits of clothing, splinters, gravel, grass or any kind of dirt should be gently picked or washed out of the wound.

Be careful not to wash or carry any dirt into the wound. If you use swabs or pledgets, use them first on the wound, and then, if necessary, on the adjacent parts if these have to be washed. Do not wind up the use of each swab with a final dab on the wound.

After the wound has been well cleansed, to keep it clean take a pledget of cotton-wool, soak it well in the antiseptic solution which has been used to wash the wound, squeeze it dry, and place it over the wound. The edges of the wound should be brought as close together as possible by applying across it two or three long narrow strips of adhesive plaster.

To Arrest the Bleeding.—This has been sufficiently treated of under "Hemorrhage and Its Immediate Treatment."

Dressing the Wound.—To dress the wound proceed as follows:

If ready-made antiseptic surgical dressings are not at hand, or are not easily procurable, place on the wound either a piece of clean linen which has been recently washed and just ironed, or has been well boiled for five minutes and then hung out; or a piece of lint soaked

in carbolic solution (1 part in 40 of water) or in carbolic oil (1 of acid in 40 of olive oil), or in turpentine; and fix it by a bandage applied as indicated under bandaging.

When a finger is all but cut off, it should be immediately fastened firmly in place again with adhesive plaster, and a physician sent for. So long as there is even a piece of skin holding the finger on it may heal, as the skin may give it a blood supply to keep it alive until repair has taken place.

To Keep the Parts at Rest.—After the wound has been dressed, the part, if it is the upper extremity, is to be kept at rest by a sling, or a splint and a sling if the wound is near a joint; if it is in the lower extremity a splint may be necessary. The leg, if wounded, should be supported on a cushion or pillow. If the abdomen is wounded, the patient should lie on the uninjured side, with the knees drawn up, or on his back if the wound is in front. The position should be as comfortable as possible.

To Treat Shock, If Present.—This is to be done as laid down under "Hemorrhage and Its Immediate Treatment."

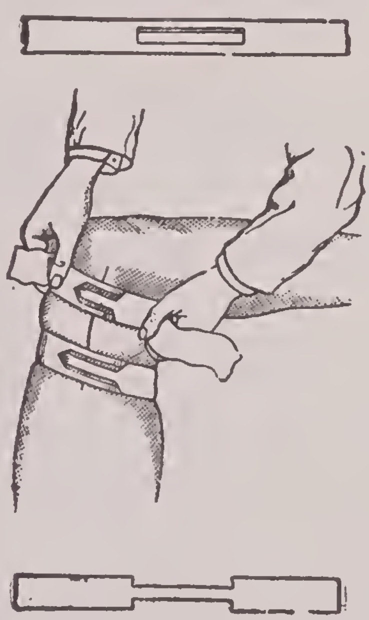


Fig. 173. How to strap a wound that gapes. The straps will take the place of stitches for a shallow wound. Above and below are shown how to prepare the straps—a slit in the middle of one (above) and the middle of the other cut narrow. The straps should be made of adhesive plaster. One end of each strip is stuck on the skin beside the wound; one strip is then passed through the other. The edges of the wound are drawn together and the strips are then pressed down to adhere.

1. **Immediate Treatment of Incised Wounds.**—Arrest the bleeding, wash and dress the wound as indicated above. If the edges of the wound gape, after washing it adjust the edges by means of strapping applied as indicated in the figure (taking care not to completely cover the wound), and then dress it. If a toe or finger has been nearly cut off, put it back in place and keep it there, as it will very likely grow on again.

2. **Immediate Treatment of Contused Wounds.**—Apply pressure

to the part, to prevent further swelling, by a pad of cotton-wool or linen, and fix it by a narrow-folded triangular bandage or a figure-of-eight roller bandage; or apply to the part a piece of lint which has been soaked in a lotion consisting of alcohol (or spirits of wine) one-third, water two-thirds. Change or wet it often. If the bruise is near a joint, apply a splint to keep it at rest.

3. **Immediate Treatment of Punctured Wounds.**—Arrest the bleeding, wash and dress the wound. If the pain is very great, apply a poultice. In case of a needle be careful to see if it is broken and a part left in. Keep it to show the doctor. Gunshot wounds are at the same time punctured and contused and should be treated as these. A fish-hook in the flesh should be pushed through and the barb broken off and the rest then withdrawn; or cut down on the barb with a sharp, clean knife.

4. **Immediate Treatment of Lacerated Wounds.**—Wash and dress the wound. As shock usually supervenes after severe lacerations, it will have to be treated.

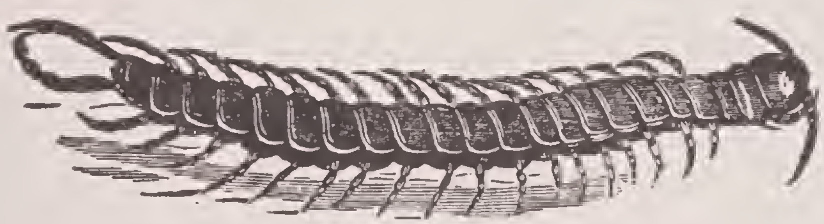


Fig. 174. The centipede. Its bite is poisonous.

Poisoned Wounds.—These may be:

1. **The True Poisoned Wound**—any of the preceding wounds may be poisoned by the introduction of decomposing animal matter or other dirt.

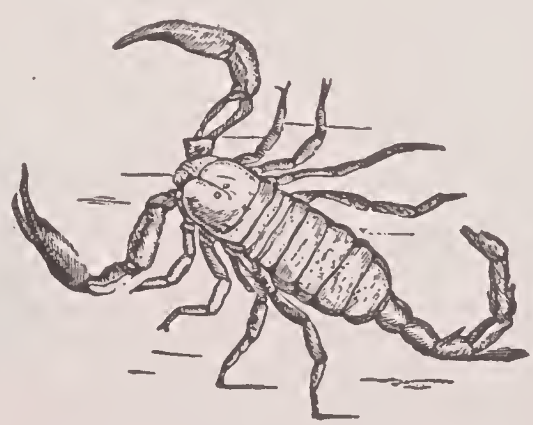


Fig. 175. The scorpion. Its bite is poisonous.

Treatment.—Wash the part immediately with a strong disinfectant, being careful to remove all foreign matter and to wash the wound to the bottom. Then dress as directed under "Simple

Wounds." Wounds from rusty nails, stable or garden tools or anything likely to have stable or garden dirt on it, should be freely opened and washed out right to the bottom to get rid of the germs of lockjaw. Fire cracker or toy pistol wounds must also be very thoroughly opened up and disinfected as they are apt to cause lockjaw. (See Tetanus.")

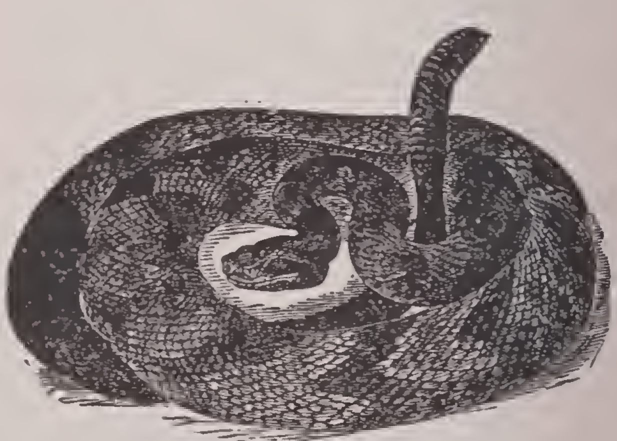
2. **Stings of Insects.**

Fig. 176. The *tarantula* spider. Its bite is poisonous, but seldom, if ever, is it fatal.

Treatment.—Extract the sting with a watch-key placed over the sting and pressed firmly down. Never use a tweezer to pull out a sting, nor pinch it. The best way is to scrape it out with a sharp knife. Apply a solution of ammonia, soda, or potash to the part or apply a piece of wet clay; wash the wound with an antiseptic solution. Shock may sometimes supervene; if so, give stimulants freely.

3. **Snake-bites.** Do not stop to kill the snake.

Fig. 177. The rattlesnake, coiled ready to strike. The "rattles" are on the tail and one is added every year when the snake casts its skin.



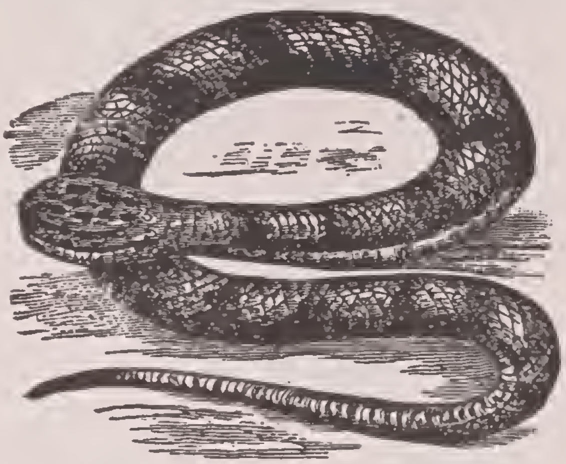
Treatment.—(i) Send for medical aid at once.

(ii) In the meanwhile, prevent the absorption of the poison into the system generally by immediately applying a ligature on the limb

between the wound and the heart. The fang-stabs should be opened up with a sharp knife.

(iii) Destroy the poison already in the wound by bathing the part first with warm water and encouraging bleeding, then with strong antiseptic solutions, sucking the wound; and finally cauterize it with a red-hot iron or nitrate of silver.

Fig. 178. The water moccasin or cotton mouth snake. It is 2 or 3 feet long, brown above, dark yellow green on its side and has dark bands, indistinct below. The belly is leaden gray and the tail dark. Its bite is very poisonous.



(iv) Treat the shock by administering stimulants freely and using artificial respiration if necessary.

Caution.—In sucking the poisoned part the operator should see that he has no cuts or fissures about the lips or tongue, and should spit out, instead of swallowing, his saliva.

4. **Dog-bites.** (See also "Hydrophobia.")

Treatment.—The same as for snake-bites.

Bee-stings are poisoned wounds. They are seldom dangerous, although for a time they may be quite painful. Careful examination may show the sting of the insect still in the wound. It should **not** be pulled out with tweezers, but it should be **scraped** out with a knife edge. This will avoid squeezing the poison in the sting into the flesh. Ammonia-water, spirits of camphor, saliva or baking soda wet with saliva may be applied. A cold-water compress may be put on to prevent swelling. The application of mud is sometimes useful.

Mosquito-bites are often a source of great annoyance and disfigurement, from the itching, scratching and swelling. The annoying itching may be allayed by touching the bites with carbolized oil, ammonia, or spirits of camphor, or with a cooling evaporating lotion. Dampened salt rubbed on the spot is sometimes useful. It is said that **crude oil** smeared on the skin will keep mosquitoes off. **Quinine sulphate** dissolved in a little water, vinegar and glycerin and applied to the skin is also a preventive of insect-bites.

Subject Reference

For further Information and Surgical Treatment of Strains, Sprains, Wounds and Dislocations, see Vol. 2, pages 107-118.

Quick Treatment

for

Sprains, Dislocations and Fractures. Definition, Causes and Signs.

Sprains or Strains.

Definition.—A sprain is the straining or tearing by a sudden **twist** or wrench of ligaments which surround a joint; a sprain is practically a "missed dislocation." It is comparable to a fracture, as it is a **break** of ligaments.

Causes.—Falls or any sudden and unnatural movement of a joint.

Signs.—Pain, heat, weakness and swelling at the seat of the injury, followed by discoloration of the skin.

Treatment.—Put the parts at complete rest; if it is a joint of the upper extremity, place the limb in a sling; if it is a joint of the lower extremity, place the limb in a back splint, elevate it, and put the patient to bed.

Apply bandages, dipped in cold water, or an ice-bag to the joint; if the pain is severe, and these cannot be borne, bathe the part with hot water at a temperature of 100° F., or apply a hot bran poultice.

The ankle and the wrist are the commonest parts to be strained. A firm bandage (best of flannel) applied from the toes or the fingers to above the injured joint will give quick relief. In the case of the ankle adhesive strappings, rather firmly applied obliquely across the front and sides of the joint will enable the patient to walk with fair comfort.

In very severe cases a surgical operation may be necessary, to expose the torn ligament and stitch it back in place.

Muscles are subject to sprains and strains by which some of the fibers are overstretched or broken, causing at the time a sharp and severe pain. Swelling and discoloration result.

The muscle should be supported by adhesive strapping or by bandaging, for six or eight weeks. Massage then will help to overcome any stiffness.

Dislocations.

Definition.—A dislocation is the displacement of the end of a bone in a joint.

Causes.—The same as those of a sprain, but in a more violent form.

Signs.—

1. Distension of the joint.
2. The end of the displaced bone may be felt through the skin.
3. Alteration in the length of the limb.
4. Loss of movement at the joint.
5. Pain in the joint, increased in trying to move it.

Treatment.—Make no attempt to reduce the dislocation, but send for medical assistance, and put the parts at complete rest and place the patient in an easy position. If no doctor can be got, see the directions in the Surgical Section.

Fractures.

Definition.—A fracture may be defined as a broken bone.

Causes.—1. **Direct violence,** by means of which the bone is broken at the seat of injury.

2. **Indirect violence,** by means of which the bone is broken at some distance from the point where the direct violence is applied by transmission of the force; e. g., fracture of the collar-bone by a fall on the hand, fracture of the base of the skull by a fall on the feet from a height.

3. **Muscular action**—snapping the bone across by a sudden and violent contraction, e. g., the kneecap in jumping.

Kinds.—Fractures are of two kinds:

1. **Simple,** where the bone only is broken.
2. **Compound,** where the bone is broken and there is a wound through the skin communicating with the break.

Either of the above kind may present the following varieties:

(i) **Comminuted,** where the bone is broken into several fragments.

(ii) **Complicated,** where the fracture is complicated by an injury to the surrounding parts, as the tearing of an artery, vein, or nerve, the opening up or the dislocation of a joint, the tearing of the lung or bladder, etc.

(iii) **Greenstick,** where the bone is incompletely broken or bent, like a green stick. It is common in children, as their bones are somewhat pliable.

(iv) **Impacted,** where the bones are broken and the ends are jammed together.

Signs.—The signs of a fracture are:

1. Pain, swelling, and deformity at the seat of injury. The pain is at the break, even when it is elicited by pressure at a distance.
2. Unnatural mobility where none should exist.
3. Loss of power in the limb.
4. Shortening of the limb.
5. Crepitus, i. e., a sound and feeling of grating, caused by the rough ends of the bones moving one against the other.

In the **Immediate Treatment** of a fracture the following points have to be attended to:

1. The prevention of further injury.
2. The proper transport of the injured person.

The Prevention of Further Injury.—For this the following measures must be adopted:

(i) Attend to the patient on the spot where the injury has occurred, and especially so if the fracture happens to be in the lower extremity.

(ii) In handling the patient and examining the injured part, use extreme care and gentleness.

(iii) Without removing the clothing, bring the bones back into their relative position as follows: First lift the limb by grasping it very gently but firmly above and below the seat of fracture, and then make gentle extension on it, i. e., stretch it, to restore it to its natural position as far as possible. It may be necessary to remove the clothing. Do this by ripping up the seams, which can be sewed up afterwards. A shoe may have to be cut off a wounded foot.

(iv) Keep the limb fixed in this position by means of splints, which are rigid supports applied to parts to increase either their natural stiffness or to prevent their undue mobility. For the surgeon's use splints are constructed out of various materials, and are shaped to fit the limbs. For the "first aid" treatment of fractures splints can be made out of various articles in daily use, according to the circumstances the patient may happen to be placed in at the time: e. g., in domestic life, broom handles, cardboard, newspapers, umbrellas, walking sticks, etc.; in workshops, pieces of wood, laths, tools, rules, squares, etc. The arm is well supported by bandaging it to the chest, after putting the hand in a sling. A broken leg may be bound to the sound one with three or four handkerchiefs or suspenders.

With military surroundings, a rifle for fracture of the thigh, a

sword or sword bayonet for fracture of the leg, a bayonet for fracture of the arm or forearm naturally suggest themselves.

Improvised splints should be chosen out of material which is sufficiently stiff to keep the parts in position; they should be made long enough to extend for some distance above and below the seat of in-

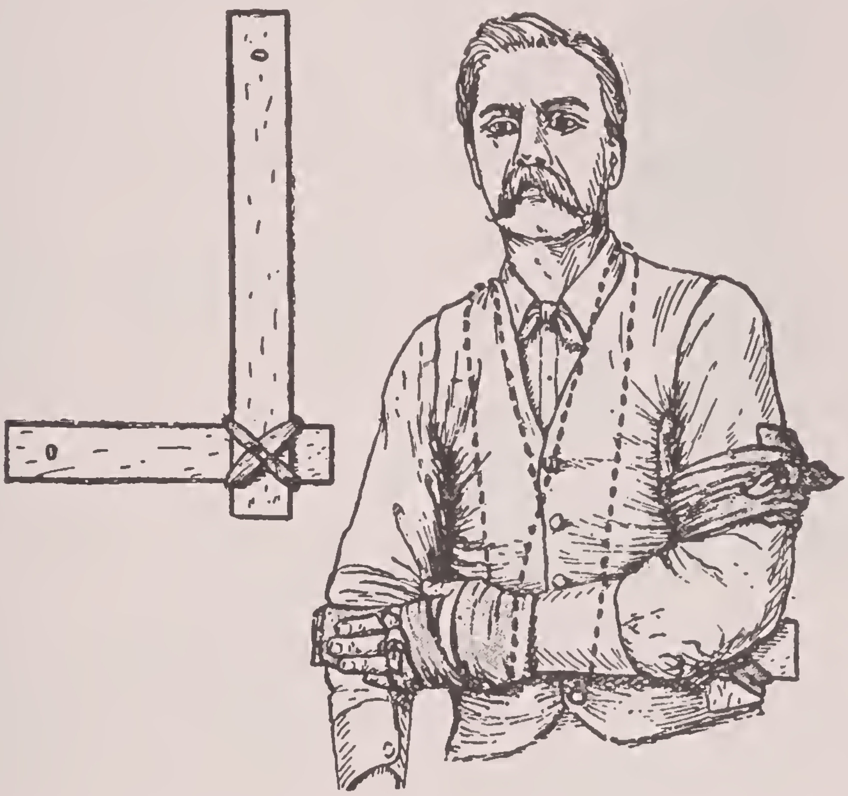


Fig. 179. The L-shaped splint and how to use it for fracture near the elbow. The dotted lines indicate a narrow arm-sling, which should be put on after the splint.

jury, and as wide as the limb to which they are to be applied; and before applying them they should be padded on one side with some soft material, such as tow, cotton-wool, old flannel, etc., and the padding should extend well over on each edge of the splint.

To apply the splints two persons are required; one keeps up gentle extension in the manner indicated above, while the other person applies the splints, one on each side of the limb, with the padded surface to it, and fixes them in position by tying them above and below the seat of fracture with triangular bandages folded narrow, as directed under "Bandaging," or with straps, belts or tapes.

Improvised splints should always be put on in such a way that they can be easily removed if required. The tips of the toes or fingers should be examined to see if they are cold and blue from too tight a bandage.

The Proper Transport of the Injured Person.—Here it is important

to bear in mind that persons suffering from fractures are not to be removed till the broken bone has been first splinted up; and if able to walk, they should not be permitted to go either to the surgeon or home unassisted, as faintness, giddiness, or even unconsciousness, may come on even some time after a fracture.

Fig. 180. How to splint and support a broken arm, using slats and handkerchiefs or triangular bandages.

Most persons suffering from fractures of the upper limb can walk if assisted. A sling for the arm is easily made with two handkerchiefs, or by pinning the coat sleeve to the breast of the coat, or by turning up the bottom of the coat over the arm and pinning it to the front.

Fig. 181. For fracture of the collar-bone. A pad is placed in the armpit and two folded triangular bandages (or handkerchiefs) are used to keep the elbow up and close to the side.

Persons suffering from fractures of the lower extremity should always be carried on a stretcher, and this should be done in accordance with the instructions laid down under "Transport of the Sick or Injured."

The Immediate Treatment of a Compound Fracture.—Here proceed as follows:

If there is hemorrhage, arrest it either by elevating the limb or by applying pressure to the main artery above the wound. If transport is readily available, and skilled help can be quickly obtained, leave the wound untouched; apply splints as indicated above, and remove the patient from the scene of the accident. If skilled aid cannot be speedily procured, remove the clothing at the seat of the injury, thoroughly cleanse the wound with an antiseptic solution, adopting the precaution laid down in the treatment of wounds, apply an antiseptic dressing, then put on the splints as above, and remove the patient.

INSTRUCTION TWENTY-FIVE—*Removal of Injured.*

How to Move or Transport the Sick or Injured

REMOVAL BY HAND OR STRETCHER.

The Position of the Sick or Injured During Transport.—This will depend upon the nature, the extent, and the site of the injury.

1. **The Sitting Posture** is suitable to those who are slightly wounded in the upper part of the body, and in whom there are no general symptoms of being ill present.

2. **The Semi-recumbent Posture** is applicable to patients who are wounded in the region of the chest, and are suffering more or less from difficulty in breathing.

3. **The Recumbent Posture** is best for those who are severely wounded, and to all those who with slight wounds show signs of faintness, shock, or a tendency to bleeding.

Patients suffering from the following injuries should always be removed in the recumbent posture:

Fractures of bones.

Wounds of the joints of the lower extremity.

Severe wounds of the head, chest, or abdomen.

Extensive injuries of the shoulder-joint.

Before removing a patient, care should be taken to give him the necessary "first aid" treatment for any urgent symptoms, and to loosening the clothes about his chest.

A.—Removal by Hand.

This may be effected by—

(i) The help of a single bearer.

(ii) The help of two bearers.

1. **Removal by a Single Bearer.**—Patients with injuries of the head, neck, or upper part of the trunk, or in a state of unconsciousness, may be removed in one of several ways by single bearers; the following four methods are the most useful:

(i) **In An Upright Position** the bearer places his shoulder in the injured man's armpit on the sound side, the patient passes his arm behind the back of the bearer's neck and over the distant shoulder, and the bearer grasps the wrist of it with the hand of that side and his other arm he places firmly about the patient's waist. In this way the bearer is able to support the patient entirely should he become faint.

Fig. 182. Removing a disabled patient who can walk.

Fig. 183. How to carry a person single-handed. Note that the injured part is away from the carrier.

(ii) **In the Arms Like a Child.**—The bearer lifts the patient by placing one arm round the patient's waist and the other arm under the patient's knees, the patient being in a sitting position and himself assisting by placing one or both arms round the bearer's neck. This method is suitable where the patient is light and the distance short.

(iii) **Pick-a-Back, or En Cheval.**—The patient places himself on the bearer's back with his arms over the bearer's shoulders; the bearer

gets both his arms well under the patient's knees and grasps with one hand the patient's wrist on the opposite side, thus preventing the patient from slipping off (Fig. 184). In this way a bearer can carry a patient of his own weight or heavier a considerable distance.

If the injured person can hold himself on easily and there is far to go, the carrier may grasp the edges of his own coat in front and thus relieve the strain on his arm muscles in supporting the weight of patient's legs.

Fig. 184. Carrying a person pick-a-back (en cheval).

(iv) **The "Fireman's Lift."**—Proceed as follows:

Kneel down on one or both knees, turn the patient face downwards, straighten his arms down by his sides and take hold close up

Fig. 185. The first step in the "Fireman's Lift."

under each armpit, passing your hands in front of his shoulders; raise the body as high as it can be lifted in that position, and allow it to rest on one of your knees (F. 186); then push your arms round his waist, interlock the fingers and lift the person to an upright

Fig. 186. The second step in the "Fireman's Lift."

position; after this, take hold of the patient's right wrist with the left hand, bring his right arm round your neck, place your head beneath his body and drop into a stooping position, at the same time pass your right arm between (if a man) or around (if a woman) the patient's

Fig. 187. The third step in the "Fireman's Lift." In raising the body, get under it partly by moving forward, partly by drawing the body toward you.

Fig. 188. The fourth step in the "Fireman's Lift."

legs, and bring his weight well on to the center of your back, then grasp the patient's right wrist with your right hand, and balancing the body on your shoulders, rise to the erect position.

Fig. 189. The final step in the "Fireman's Lift" when the subject is a man.

Fig. 190. The final step in shouldering a woman by the "Fireman's Lift."

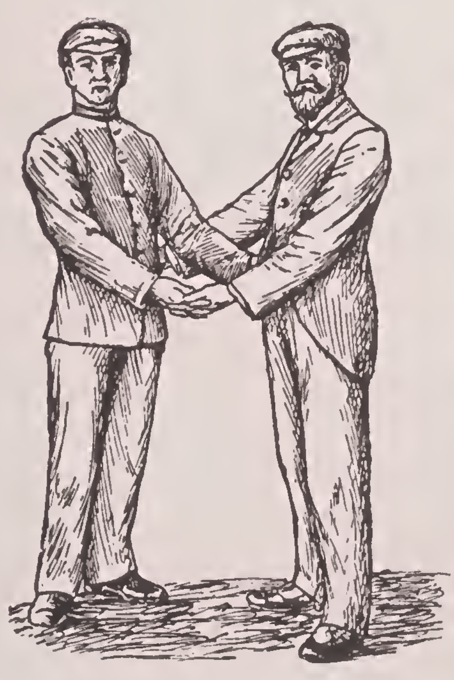


Fig. 191. The two-handed seat ready.

Fig. 192. Carrying a patient by means of the two-handed seat.

A woman would be carried as shown with the bearer's right arm round both the legs.

This method is applicable to a person who is unconscious, but whose extremities are uninjured.

2. **Removal by Two Bearers.**—Two bearers can remove a patient by—

(i) Hand seats.
(ii) Improvised seats.
(iii) In a horizontal position.

(i) **The Hand Seats** are as follows:

The Two-handed Seat.—This seat is suitable for patients who are more or less helpless and have to be lifted from the ground.

Fig. 193. The three-handed seat ready.

Fig. 194. Carrying a patient by the three-handed seat.

Procedure.—The bearers take up their position on the right and left of the patient, face inwards and kneel on the knee nearest his feet. Placing their hands beneath the patient's armpits, they raise him into a half-sitting position, and rest him against their other knees. Now passing their arms in front beneath the patient's thighs, they lock fingers with palms uppermost to form the seat, and rising steadily together, lift the patient from the ground, and at the same time place their disengaged hands on each other's hips to support the patient's back, who, if able, will pass one arm round the neck of each bearer.

The disadvantages of the "two-handed seat" are:

It is very trying to bearers and cannot be kept up for any long distance.

The entire weight of the patient is thrown on the two arms, and chiefly on the interlaced fingers; therefore only a limited number of muscles are brought into action and fatigue quickly results. The hands forming the seat may take hold on each other by hooking the half-shut fingers together (butcher's hold) as a change, and it is also easy to set the patient down and change sides.

The Three-handed Seat is suitable for patients who can support themselves, more or less, while they are being lifted. It is unsuitable for patients in a fainting condition, as they are carried too nearly upright and might tumble forwards.

It is, however, firmer than the two-handed seat, and as the bearers can turn more to the front, they can march better than in the case of either the two or the four-handed seat.

Fig. 195. The hands in the "four-handed seat." (The two upper hands are those of one person as indicated by the sleeves.)

Procedure.—The bearers place themselves on the right and left of the patient and turn inwards. The bearer on the right grasps his own left forearm with his right hand, and with his left hand he grasps the left forearm of the bearer on the left. The latter grasps with his left hand the right forearm of the bearer on the right and places his right or disengaged hand on the left shoulder of the right bearer. The two bearers then stoop down and place the seat thus formed beneath the patient's hips and lift him, the patient at the same time helping to support himself by clasping each bearer round the neck.

The Four-handed Seat is suitable for patients who are well able to support themselves by placing their arms over the shoulders of the bearers.

The seat is an easy and secure one for the person who is carried, and as all the ordinary muscles of the arms are used the weight is well borne by the bearers.

Procedure.—The bearers, after taking up their position on each side of the patient, turn inwards, grasp their own left wrists with their right hands, and each other's wrists with their left hands, stoop down, pass the seat thus formed beneath the hips of the patient, who having placed himself well on it, passes his arms round the shoulders of the bearers as they rise up to the erect position.

Note.—The ease of carrying by the hand-seats is greater if the bearers, when marching together, press strongly inwards.

Fig. 196. Making the "four-handed seat."

Fig. 197. Carrying by means of the "four-handed seat."

In carrying patients on hand-seats, the bearer on the right of the patient steps off with the right foot and the bearer on the left with the left.

(ii) **Improvised Seats.**—These can be constructed out of canvas, straps, a conveniently shaped board, a roller towel, etc., passing over the bearers' shoulders. On them patients can be carried in a comfortable sitting position with less fatigue to the bearers than with the hand-seats.

(iii) **In a Horizontal Position.**—The "fore and aft carry" is as follows:

One bearer stands at the head of the patient while the latter is sitting, stoops down, passes his arms under the patient's armpits and clasps his hands in front of the patient's chest; the other bearer steps between the patient's feet with his back to the patient, stoops down and grasps the patient's legs behind the knees. Both bearers then rise together.

In some cases it is better for the second bearer to have both the patient's legs (in carrying a woman) under his arm at one side.

A second horizontal method is this:

Both bearers stand on the same side of the patient, the first opposite his shoulders; the second opposite his hips—and kneel down. The first bearer passes his hands under the shoulders and back of the

Fig. 198. Transporting a patient by the "fore-and-aft carry."

patient, the second bearer passes his hands, wide apart, under the thighs and calves of the patient, and the two bearers then rise steadily together. The patient, if he is able, clasps with his two hands the shoulders of the first bearer.

B.—Removal on Stretchers.

A Stretcher is a piece of canvas stretched on a specially constructed oblong frame forming a firm support on which a patient can be carried in a horizontal position.

Various forms are in use, the form depending upon the requirements for which the stretchers are needed, whether military or civil. But the principle of construction is the same in all and can be best explained by a detailed description of—

The British Army Regulation Field Stretcher Mark V.—This stretcher consists of two poles, two traverses, the canvas, a separate canvas pillow, feet with rollers, and a pair of slings, all of which fold up into a convenient package for carriage.

The Poles are made of strong seasoned ash. They are 7 feet 9 inches long, and are square throughout their whole length except the handles, which are rounded to fit the hands of the bearers. The poles are held apart to the required width by the two traverses.

The Traverses are flat wrought-iron jointed bars, and are fastened to two strong plates of the same material, rivetted to the under surface of the poles twelve inches from their ends. These traverse plates are fitted with rackets, each carrying a 3-inch wooden roller, by means of which the stretcher is raised from the ground. Each traverse joint, which is of the scissor variety, closes inwards and allows the poles to come together.

The Canvas, which is tanned, is attached along the outer side of each pole by copper nails through an edging of leather; there are eyelet holes in the canvas at both ends for the attachment of the pillow.

The Pillow also is made of tanned canvas. It is wedge-shaped and is attached to the canvas by two laces or strings which pass through the eyelet holes and are fastened underneath.

The Feet or Rollers are made of boxwood, and are fixed to the rackets on the under surface of the poles. They are large, raising the stretcher about 6 inches from the ground.

The Slings are either strong leather straps or strips of tanned web, sixty inches long and two inches wide, with a loop at each end; one loop is furnished with a buckle by means of which the sling can be lengthened or shortened according to the height of the bearers, and at the opposite end there is a narrow transverse strap, twenty-one inches long, fixed at right angles; this is used to buckle round the stretcher when closed.

The dimensions and **weight** of the stretcher are as follows:

Length of canvas, 6 feet.

Length of pole, 7 feet 9 inches.

Width, total, 1 foot 11 inches.
Height, 5⅞ inches.
Weight, 34 pounds.

Improvised Stretchers.—The best are those which can be easily and efficiently constructed at the time and on the spot. The following are some of the methods of improvising stretchers:

(i) **The Rifle Stretcher** is formed by two rifles with fixed bayonets, and a rug. "Spread a blanket on the ground, lay two rifles on it parallel to one another, each ten inches from the center of the blanket, both muzzles pointing in the same direction, trigger-guard outwards. Turn a fold of the rug six inches wide over the ends of the butts, fold the right side of the rug over the rifle on that side to the rifle on the opposite side, then similarly fold the left side. A stretcher is thus formed consisting of three folds of blanket, the end at which the butts are being the head end."

Caution.—Before using the rifles examine and make sure that they are unloaded.

(ii) **The Blanket Stretcher** is made with a rug or blanket placed on two poles of sufficient length and thickness, and the sides rolled on and tied, with two pieces of wood placed crosswise to keep the sides apart.

(iii) **The Coat Stretcher** is made thus: Two coats are taken, and after the sleeves have been turned inside out the coats are placed with their lower edges touching each other; a rifle or pole is passed through the sleeves on each side; the coats are then buttoned up, and the buttoned side turned downwards. Instead of two ordinary coats one overcoat may be used.

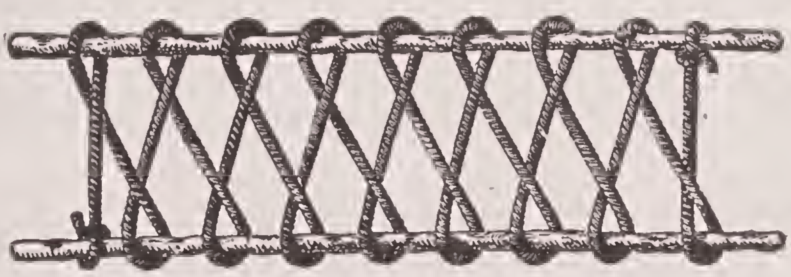


Fig. 199. An improvised stretcher, made with a rope and two poles. A blanket or clothing should be laid over the rope.

(iv) **The Rug and Pole Stretcher** is made by placing two poles along the edges of a rug longitudinally, and rolling the edges of the rug over the poles until they are twenty inches apart. Two cross-pieces add much to the efficiency of this stretcher.

(v) **The Pole and Rope Stretcher** is made of two poles placed

twenty inches apart; a long rope is then wound alternately from side to side round each pole to form the body of the stretcher. A rug, coat or blanket may be laid on the rope to cover it.

(vi) A rocking-chair or an ordinary chair makes a ready and useful carrier.

Fig. 200. How to use a rocking chair as a carrier for a sick or disabled person.

Note.—An improvised stretcher should always be tested before placing a patient on it.

Loading and Unloading Stretchers.—(i) With Four Bearers.—In lifting a patient with a fracture of the thigh on to a stretcher, the stretcher is to be placed on the opposite side to the injury, and one of the bearers must pass one hand and arm under, and the other over, the limbs to support the fracture, while the others attend to the lifting and moving of the patient.

(ii) **With Three Bearers.**—Place the stretcher at the patient's head, and in a line with his body. To lift the patient either on to or off the stretcher, one bearer, placing himself on the injured side in a line with the patient's knees, raises and supports the limbs. The other two bearers kneel on opposite sides of the patient near his hips, facing each other; they pass their arms under the back and thighs of the patient, and interlocking their fingers, raise and support the trunk. The bearers then rise to the erect position, and carry the patient, head foremost, either on to the stretcher, over the foot, or off the stretcher, over the head.

(iii) **With Two Bearers.**—The stretcher is placed as in (ii). If one of the lower limbs is severely injured, or if there are symptoms of shock, both bearers place themselves on the injured side, one in a line with the patient's knees, and the other near his hips; they then raise the patient, keeping him as far as possible in a horizontal position. If the lower limbs are intact, or only slightly injured, the patient is lifted by one of the improvised hand-seats. In either case the patient is carried, head first, on to the stretcher over the foot, or off the stretcher over the head.

The Position of the Patient on the Stretcher.—Before placing a patient on a stretcher, notice the part injured and the nature of the injury. In all cases it is important that the head should be kept low, and care should be taken that it is not pressed forward on the chest.

For Wounds of the Head.—Place the patient in such a position as to avoid any pressure against the injured part.

For Wounds of the Lower Limb.—Place the patient upon his back, inclining towards the injured side.

For Wounds of the Upper Limb.—Place the patient on his back or on the uninjured side.

For Wounds of the Chest.—Place the patient with his chest well raised and his body inclined towards the injured side.

For Wounds of the Abdomen:

(a) If the wound is transverse or punctured, place the patient on his back, put a pack or folded article of clothing under his knees to keep them bent and well drawn up to relax the muscles of the front of the abdomen.

(b) If the wound is vertical, place the patient on his back and straighten his legs.

The Carriage of Stretchers.—Two main objects are to be kept in view in carrying patients on stretchers, viz.:

To prevent as much as possible the impulse connected with the progression of the bearers from being communicated to the stretcher.

To keep the stretcher level and as near the ground as is consistent with free carriage and the absence of risk of contact.

Rules for the Carriage of Stretchers (Longmore).

Rule 1. "The front and rear bearers must 'break' the step by starting with opposite feet. By this means the stretcher is kept level, and does not 'dip' from side to side.

Rule 2. "The pace should be 18 inches, and made with a steady but easy step, particularly avoiding elevation of the bodies by springing from the fore part of the feet. The foot should be firmly planted and the knees slightly bent.

Rule 3. "The slings should be lengthened or shortened by the buckle till the extremities of the loops reach the wrists of the bearer standing at attention.

Rule 4. "The bearers should, as far as possible, be of a uniform height, build, and age.

Rule 5. "As most ground over which bearers have to carry

wounded presents irregularities of surface, it becomes an important matter for bearers to practice the transport of wounded under those circumstances, and so keep the stretcher level. The concerted action of the bearers is the principle upon which this rule is based.

Rule 6. "A sick or wounded person should as a rule be carried with his face in the direction in which the bearers walk.

Rule 7. "If the bearers have to carry a sick or wounded man uphill, the patient is taken head first, and the reverse takes place going downhill.

Rule 8. "With fractures of the lower extremity, as a rule, the patient should be carried uphill feet first, and downhill head first, in order to prevent the weight of his body pushing the upper end of the broken bone down upon the helpless and motionless portion of the limb below the seat of fracture.

Rule 9. "No attempt should ever be made to carry a helpless patient over a high fence or wall, if it can possibly be avoided, as such is always a dangerous proceeding. A portion of the wall should be thrown down, or a breach in the fence made so that the patient may be carried through on the stretcher; or if this be not practicable, the patient should be carried to a place where a gate or opening already exists.

Rule 10. "In crossing a ditch or stream, the stretcher should be first laid upon the ground near its edge. The two leading bearers should descend into the ditch, and, assisted by the two other bearers, advance the stretcher until the near end rests on the ground above; the two other bearers descend, and all four raise the stretcher and carry it to the opposite side, and the fore part being now made to rest upon the edge of the ground, while the rear part is supported in the ditch, the two leading bearers jump out of the ditch, and with the remaining bearers carry the stretcher until the near end rests upon the ground. The bearers then resume the carriage of the stretcher. In crossing a narrow ditch the bearers on either side jump in and steady the stretcher, so as to allow the head bearer to cross without shaking the patient.

Rule 11. "Patients should never be carried with the stretcher supported upon the shoulders. It is a most dangerous and hazardous position.

Rule 12. "Each of the four bearers to every stretcher must understand his particular duty intelligently. The front and rear bearers attend to the carrying of the stretcher, and the two remaining carry the haversack and the water bottle. Carefully watch the patient,

INSTRUCTING BOYS HOW TO RESUSCITATE THE DROWNED

and assist and change with those responsible for the carriage, as occasion may require."

If a stretcher has to be carried over ground which presents a general ascent, and the bearers are of different heights, the bearer at the rear end of the stretcher should be the taller. Should the ground present a general descent, then the front bearer ought to be the taller and stronger.

Country Wagons.—When it is necessary to use these, the floors should be thickly covered with straw, on which the stretchers are to be placed.

For loading and unloading wounded on stretchers, the front end of the stretcher is first rested on the floor of the wagon; the bearers of that end then get into the wagon, and the stretcher is moved forward into its place and securely lashed.

For loading a wagon with wounded, if no stretchers are available, the wounded must be lifted as in stretcher drill, and carried to the wagon. "On arriving at the back of the wagon, one bearer will get into it, and, supporting the wounded man under both shoulders, will lift him in, assisted by the other bearers, who will subsequently get into the wagon and help to place the wounded man in the most advantageous position possible."

Unloading is the converse of this proceeding.

INSTRUCTION TWENTY-SIX—*Artificial Respiration*

How to Restore Breathing by Artificial Means

Drowning — Choking — Hanging — Strangulation — Poisonous Gases — Signs of Death.

Subject Reference

For Organs of Respiration, see Vol. 1, pages 40-44.

Asphyxia.

By **asphyxia** is meant the condition which exists when breathing stops.

Causes of Asphyxia.—1. Submersion in a liquid medium, as in drowning.

2. Closing of the air passages by foreign bodies, as in choking.

3. Pressure on the chest, preventing the action of the respiratory muscles.

4. Closure of the air passages, as in suffocation or smothering.

5. External pressure on the air passages, as in strangulation or hanging.

6. Breathing certain gases, such as nitrogen, hydrogen, carbonic oxide, sulphuretted hydrogen, chlorine, chloroform vapor, etc.

Treatment of Asphyxia.—For some minutes (usually about four) after the respirations have entirely stopped the heart's action continues, and so long as it does so recovery from asphyxia is possible.

The main indications for treatment are:

1. To remove, if possible, the cause of the asphyxia.

2. To effect the purification of the blood by introducing fresh air into the lungs by means of artificial respiration or otherwise.

Treatment of Asphyxia from Drowning.—The appearances presented by a person who has been immersed for some time in the water are as follows:

The face is swollen and purple.

The lips are livid and the eyes bloodshot.

The mouth, windpipe, and lungs contain a frothy fluid, and there is a considerable quantity of water in the stomach.

The feet and hands may be swollen and discolored.

The body is cold.

In treating the apparently drowned, the attention must be directed to the following points:

1. The condition of asphyxia due to submersion and to the blocking of the air passages with water, mud, etc.

2. The shock to the system.

3. The exhaustion from long-continued struggling.

4. The effect of exposure to the cold.

But to remove the condition of asphyxia as soon as possible is the most important factor in the treatment.

Directions for Restoring the Apparently Drowned.—1. Send immediately for medical assistance, but proceed to treat the patient instantly, securing as much fresh air as possible.

2. The points to be aimed at are, first and immediately, the **restoration of breathing,** and secondly, after breathing is restored, the **promotion of warmth and circulation.**

Treatment to Restore Natural Breathing.—(i) Secure a free entrance of air into the air passages. To effect this, remove all tight clothing constricting the neck and chest; look to the mouth, and quickly cleanse it of all mud, weeds, lumps of food, etc.; draw the tongue forward, and secure it there, if possible, by an elastic band or

a string or strip of handkerchief passed over it and under the chin, or have someone hold it drawn out with a towel or handkerchief to grasp it; look to the nostrils, and free them from any obstruction.

(ii) Drain off any water from the chest or stomach; to do this turn the body on the face, the pit of the stomach being raised above the level of the mouth by a large hard roll of clothing placed beneath it. Make steady pressure upon the patient's back over the roll of clothing, so as to press all fluids in the stomach out of the mouth, and repeat it once or twice, until fluid ceases to flow from the mouth. Or grasp the patient around the waist as he lies face down, lift the body and give it two or three sharp jerks to free the throat of mucus; hold the body thus until no more water runs out of the mouth.

(iii) If the breathing has ceased place the patient on his back on a flat surface, inclined a little from the feet upwards, the head and shoulders being raised and supported on a small firm cushion or folded article of dress placed under the shoulder blades. Imitate the movements of breathing, by commencing at once Silvester's method of artificial respiration, and continue it till the patient breathes.

(iv) Employ whatever other means may be available to promote recovery.

During the performance of artificial respiration, if any assistants are at hand get them to excite the nostrils with snuff or smelling salts, or tickle the throat with a feather; to rub the face and chest briskly; to dash hot and cold water on them alternately.

Artificial Respiration.

Various methods have been proposed for performing artificial respiration, but the ones most usually adopted are:

1. Dr. Silvester's method.
2. Dr. Benjamin Howard's "direct" method.
3. Dr. Marshall Hall's "ready" method.
4. The "tongue traction" method.

First see that any obstacle to breathing is removed. If the person is drowned, first turn him on his face, stand astride of his body, pass your hands round his waist and clasping them, raise the body and give it two or three quick jerks. This will allow any water in the lungs to run out and it will also dislodge mucus from the throat. A finger covered with a handkerchief may be passed into the throat to make sure that no mucus remains there. Artificial respiration must be kept up for at least two hours if the patient does not revive sooner.

1. **The Silvester Method.**—This method has the following points to recommend it:

(i) It is simple.

(ii) It is effective.

(iii) It is to a great extent in harmony with the process of respiration in Nature.

(iv) The expansion of the thorax is artificially insured, and wholly under the control of the operator.

(v) The patient is not liable to be injured by the manipulations.

(vi) Both sides of the chest are equally inflated, and a large amount of air inspired.

(vii) It is most easily adopted and remembered, and can be put into operation by one person.

Fig. 201. Silvester's method of resuscitating the drowned or asphyxiated. First position

Mode of Procedure.—Place the patient on his back on the floor, loosen all tight clothing about the neck, chest, and abdomen, and loosen his braces; place a block or pillow under the patient's shoulders (this has the effect of throwing the chest out, extending the neck, and throwing the head back), draw forward the tongue, and get an assistant to hold it with a handkerchief between the thumb and finger; if unassisted, fasten the tongue around the chin by an india rubber band, a piece of string or a strip of handkerchief. Now kneel at the patient's head, take hold of his arms above the elbows, and carry them outward from the body well over the head, as far as they will go (this will have the effect of raising the ribs and expanding the chest, and air will

generally be heard passing into it); hold the arms in this position for two seconds, then bring the arms down against the sides, cross the forearms over the stomach (bringing the elbows together), lean well forward upon them, and make forcible pressure upon the abdomen, so as to press the diaphragm upwards; keep up this pressure for two

Fig. 202. Silvester's method of resuscitating the drowned. Second position.

seconds; this will have the effect of expelling air out of the chest. Repeat these movements carefully and deliberately about fifteen times a minute till the natural respiration has been established, which will be indicated by the patient beginning to take short gasps, then cease the movements, but watch the patient carefully for some time, as the respiration may again fail after it has been restored.

2. **Dr. Benjamin Howard's "Direct" Method.**—The following are the rules of procedure:

1. **Instantly** turn the patient downwards, with a large firm roll of clothing under stomach and chest. Place one of his arms under his forehead, so as to keep his mouth off the ground. Press with all your weight two or three times, for four or five seconds each time, upon the patient's back, so that the water is pressed out of lungs and stomach and drains freely out of the mouth. Then—

2. **Quickly** turn patient face upwards, with roll of clothing under back just below shoulder blades, and make the head hang back as low as possible. Place patient's hands above his head. Kneel with patient's hips between your knees, and fix your elbows firmly against

your hips. Now—grasping the lower part of patient's naked chest—squeeze his two sides together, pressing **gradually** forward with all your weight, for about three seconds, until your mouth is nearly over that of the patient; then, with a push, **suddenly** jerk yourself back. Rest about three seconds—then begin again, repeating these bellows-blowing movements with perfect regularity, so that foul air may be pressed out and pure air be drawn into the lungs about eight or ten times a minute, for at least one hour, or until the patient breathes naturally.

Note.—The above directions must be used on the spot, the first instant the patient is taken from the water. A moment's delay—and success may be hopeless. Prevent crowding around patient; plenty of fresh air is important. Be careful not to interrupt the first short natural breaths. If they be long apart, carefully continue between them the bellows-blowing movements as before. After breathing is regular, let patient be rubbed dry, wrapped in a warm blanket; be given hot spirits and water in small occasional doses; and then be left to rest and sleep.

Dr. Howard claims a superiority for his method for the following reasons:

1. The direct method alone provides for a thorough preliminary ejection of fluids from the stomach and thorax.

2. This method alone makes the drainage of the pharynx constant, precluding failure from obstructions there, or suction thence into the trachea.

3. In this method the usually impracticable task of opening the mouth and pulling forward the tongue is more than superseded by simple position.

4. This same position also secures, and that in the only way possible, the instant elevation of the epiglottis.

5. The compression by this method is the most complete, and capable of the most delicate adaptations.

6. It is the only method which can be practiced by one person, and which by the same person can easily be continued as long as it may be of use.

3. **Dr. Marshall Hall's "Ready" Method.**—This is the least efficient of the three methods, as only one side of the chest is compressed. It is the mildest, and requires considerable practice before one can become efficient in it.

Mode of Procedure.—Take up a position on the left side of the patient; place a roll of clothing (which must be twice as long as that

used in the other methods) in such a manner that when the patient is turned over his chest will be on the roll. Now turn the patient face downwards, with the body reclining over the roll of clothing, and press firmly with the hand upon the back; then turn the body on to the side again. Then the patient is alternately rolled on to the roll of clothing and pressed down on it with the hand, and then rolled off it on to his back or side. Repeat these movements, and continue them at the rate of fifteen times a minute till the respiration has been restored.

4. In the **Tongue Traction method** the patient's tongue is firmly grasped by a towel or handkerchief and firmly pulled on and then let relax. This is repeated fifteen times a minute. It may be practiced at the same time as any of the three foregoing methods. It acts by stimulating the muscles of respiration.

In performing artificial respiration there is a tendency for the operator to act too fast and to exceed the proper number of fifteen respirations per minute.

Treatment to Promote Warmth and Circulation When Natural Breathing Has Been Restored.—Wrap the patient in dry blankets, and commence rubbing the limbs upwards firmly and energetically, either under or over the clothing. Promote the warmth of the body by the application of hot flannels, bottles or rubber bags of hot water, hot bricks wrapped in flannel, etc., to the pit of the stomach, arms, between the thighs, and to the soles of the feet. When the power of swallowing has returned, give small quantities of wine, warm brandy and water, or coffee. Put the patient to bed, and encourage sleep. During reaction the breathing may become oppressed; to obviate this apply large linseed meal and mustard poultices to the chest in front and back behind, being careful, however, not to let the weight of the poultice rest on the chest.

Watch the patient carefully for some time, to see that breathing does not fail. If any signs of failure should appear, resume artificial respiration.

Note.—The above efforts to restore life must be persevered in till the arrival of medical assistance, or until the pulse and breathing have ceased for at least two hours.

Cautions.—1. Avoid delay in the application of measures to restore life.

2. Prevent overcrowding around the patient, especially if in an apartment; have plenty of fresh air.

3. Avoid rough usage, and do not let the body remain on the back

unless the tongue is secured and drawn forward or the head is well thrown back, as in the Howard method.

4. Avoid attempts to give stimulants before the patient is well able to swallow.

5. Avoid hurried and irregular movements in performing artificial respiration.

6. Avoid an overheated room.

7. Under no circumstances hold the body up by the feet.

8. On no account place the body in a warm bath, unless under medical direction, and even then it should only be employed as a momentary excitant.

9. Do not give up too soon the efforts at restoration.

Treatment of Asphyxia by Choking.—Choking is caused by bits of food, foreign bodies, etc., accidentally passing into the larynx. Send at once for medical assistance, but in the meanwhile make attempts to dislodge the obstruction by passing the finger, the handle of a spoon, or a button-hook, well back over the base of the tongue and drawing forwards. In doing this, the best position to place the patient in is the recumbent, with the head turned on one side. If, after the foreign body has been extracted, there should be no signs of breathing, begin artificial respiration at once, and continue it for at least half an hour. A good way to dislodge a piece of meat or other foreign body in the larynx or windpipe is to give the patient a quick and rather heavy slap on the back between the shoulders. If the patient is a child, stand him with his chest against your thigh, as you sit on a chair, and give him a quick slap on the back with your open hand. This will suddenly force the air out of the chest and carry with it any obstacle in the throat.

Treatment of Asphyxia by Blocking of the Larynx, caused by Swelling of the Mucous Membrane.—Suffocation in children is frequently caused by attempting to drink from the spout of a kettle containing boiling water. Send at once for medical assistance, but proceed at once to wrap the child in a blanket, apply hot sponges, hot flannels (dry or moist), to the mouth. Administer in dessert-spoonful doses salad oil, linseed oil, or cod-liver oil; also give pieces of ice to suck. In a very urgent case, where a doctor is not in reach, life may be saved by opening the windpipe with a clean, sharp knife, cutting crosswise between the cartilages. The cut should be made about ½ to ¾ inch long, right into the windpipe.

Treatment of Asphyxia from Attempted Hanging or Strangulation.—Immediately release the patient, loosen or cut any cords which

may be round his neck, also all tight clothing; allow a free current of air to pass over his face; dash cold water over his chest and face, and restore breathing by artificial respiration.

Treatment of Asphyxia from Breathing Very Irritant and Poisonous Gases.—These gases include charcoal vapor; coal and coke vapor; the vapor of lime, brick, and cement kilns; coal gas; the foul air in sewers and cesspools, and in mines (choke-damp); the vapor of chloroform, etc.

Remove the patient at once from the foul air, loosen all tight clothing, draw his tongue forward and fix it, commence artificial respiration and apply friction and warmth to the body; dash cold water on his head and face.

The appearances which generally accompany death are as follows:

1. The **breathing has stopped**, there is no movement of the chest, the sound of air passing in and out is absent, and there is no watery vapor proceeding from the mouth.

To determine this, place a glass or saucer of water on the chest, and watch if any movement is communicated to it, making the surface tremble or move; hold a looking-glass or some cold bright surface to the mouth, and see if the surface becomes dimmed by vapor of the breath condensing upon it. Or place a down feather on at the nostril or open mouth and watch if it moves.

2. The **circulation of the blood has stopped**, there is no pulse, the movements and sounds of the heart have ceased.

To determine this, tie a ligature tightly round a finger; if there is any circulation, the end of the finger will become reddened, and the string on removal will leave a white ring round the finger.

3. The eyelids are generally half closed and the pupils dilated.

4. Coldness and pallor of the surface of the body increase. The body becomes stiffened sooner or later.

5. After the lapse of some hours signs of decomposition appear. This is the only certain sign of death.

Subject Reference

For how to avoid Poisonous Food and Water, see Vol. 2, pages 471 to 506.

All Kinds of Poisons Injurious to Health and Destructive to Life

What to Do Quickly in Case of Poisoning. How to Know and Avoid Poisonous Plants.

Special Poisons, their Symptoms, and their Immediate Treatment.

GENERAL PRECAUTIONS.

Precautions in the Care of Poisons.—In nothing else is the value of precaution greater than in poisoning, and a little foresight and care would limit the number of accidents of this kind to a very few cases. All poisonous liquids, such as liniments, disinfectants, washes, etc., should be kept in a special place in colored glass bottles (preferably of some peculiar shape, or rough, and so **easily recognized in the dark**), plainly labelled, and marked "Poison. For external use only!" The cork may also serve a warning purpose by having a peculiar top. All poisonous substances should be placed where children can not get at them, even by climbing. Children should also be repeatedly cautioned against tasting anything they find, and told that it may make them very sick or even kill them.

The appropriate antidote and treatment for the poison should be stated on the label and the necessary remedies should be at hand and not allowed to run out or be used for other purposes without being replaced.

Poisonous plants should be destroyed, if possible, and children and others should be cautioned against eating any seeds or berries of unknown plants.

The treatment of several of the commonest cases of poisoning is given in detail, in order that the procedure may be made clear.

Classification—I. Corrosives.—These soften and destroy the parts with which they come in immediate contact. Being swallowed usually, they cause a burning sensation of the lips, mouth, throat and stomach and cause vomiting, with pain in the abdomen which is increased by pressure, and by the purging which soon follows. Examples of corrosive poisons: The mineral acids (such as sulphuric, nitric, and hydrochloric); the caustic alkalies (such as potash and soda); corrosive sublimate (or bichloride of mercury); acid, alkaline, and corrosive salts (chlorides of zinc, tin and antimony, nitrate of

silver, acid sulphate of potassium, carbonate of potassium); oxalic acid; carbolic acid.

2. **Irritants.**—These cause inflammation of the part (usually the alimentary canal) to which they are applied, with symptoms similar to the above but without the destruction and coloring of the lips, etc. Examples of irritant poisons: Arsenic, the salts of antimony, zinc and other metals, elaterium, the "essential" oils, Spanish fly.

3. **Narcotics.**—These act chiefly upon the nervous system, producing headache, giddiness, numbness, stupor, delirium, convulsions, or coma, and death. Examples of narcotic poisons: Opium, prussic acid, belladonna, chloroform, chloral, alcohol, poisonous gases. They have not a burning taste and do not cause vomiting or purging, as a rule.

4. **Narcotico-irritants.**—These combine more or less the characters of the above two. Examples of narcotico-irritants: Strychnine, aconite, hemlock, poisonous fungi.

Evidence of Poisoning is afforded by the following circumstances: 1. By the **sudden appearance** of the general symptoms of poisoning **(vomiting, purging, cramp, pain in the stomach or bowels, delirium, unconsciousness)** in a person otherwise healthy, or soon after partaking of food, drink, or medicine. Anything vomited should be kept for the doctor's inspection.

2. By **several persons being attacked** with similar severe symptoms soon after a meal, of which all have partaken.

3. By the **nature of the surroundings**, the finding of a glass or bottle with suspicious-looking contents, the smell of the room, etc. This helps to find out the special poison present, and to confirm the suspicion of poisoning.

4. By the **history of the case**, the patient having shown previously a suicidal tendency, the signs of mental depression, etc.

How to Act in a Case of Poisoning.—1. Send at once for medical assistance, and take care that the doctor is told that the case is one of probable poisoning.

2. Until the arrival of skilled attendance, proceed at once to adopt the treatment indicated below, viz.:

(i) **If you are in doubt as to the nature of the poison taken,** follow the general treatment applicable to a case of unknown poisoning.

(ii) Follow the treatment applicable to a case of special poisoning, **if you are aware of the nature of the poison.**

The General Treatment Applicable to a Case of Unknown Poisoning.—1. **Get rid of the unabsorbed poison,** if possible, from the system. This is effected by **administering an emetic** to bring the poison up; or by **administering an aperient** to pass the poison through.

2. **Counteract depression and shock** by giving stimulants and nourishments, and applying poultices and hot fomentations. Put the patient lying down on his back.

3. **Relieve pain** by means of sedatives and demulcents.

Emetics.—It is better to give too much than too little of an emetic or of an aperient. (i) Sulphate of zinc: 20 to 30 grains (a half a teaspoonful) in half a tumbler of warm water. Prompt in its action and safe. Not to be given if salt and water already given.

(ii) Ipecacuanha powder: 15 to 30 grains in warm water. Produces very little depression, and does not irritate the stomach.

(iii) Ipecacuanha wine: one to two tablespoonfuls in water. Is not very prompt in its action, and causes depression.

(iv) Mustard: a teaspoonful in a tumbler of warm water.

(v) Salt (common table salt): a tablespoonful in a tumbler of warm water. Not to be given after sulphate of zinc.

(vi) Tepid water: large draughts of soapy or greasy water, followed by irritation of the back of the throat by means of the finger or a feather.

Any of the above emetics may be repeated once or twice, if necessary; the action of an emetic is facilitated by giving plenty of tepid water, and by putting the finger or a feather into the throat a few minutes after the emetic has been given.

Patients suffering from narcotic poisoning are **not easily** made to vomit. But in any case of poisoning be sure to cause vomiting as soon and as freely as possible.

Aperients.—(i) Castor-oil: one to two tablespoonfuls for a dose.

(ii) Sulphate of magnesia (Epsom salts): a tablespoonful in a tumbler of warm water. Repeat in an hour if necessary. This is also an excellent **antidote** to carbolic acid.

Stimulants.—(i) Sal volatile (aromatic spirits of ammonia): a half to one teaspoonful in a tablespoonful of warm water.

(ii) Spirits (brandy or whisky): from a teaspoonful to a tablespoonful, according to circumstances.

(iii) Strong tea (green is preferred to black) or coffee, by the mouth or rectum.

(iv) Strong beef-tea, by the mouth or rectum.

(v) Hot and cold douche, alternately.

N. B.—If the patient can not swallow, give the spirits, tea, coffee, or beef-tea, as an enema.

Sedatives and Demulcents.—Bland, non-irritating fluids (which soothe internal local irritation and relieve pain), such as milk, raw eggs, barley-water, arrowroot, flour and water, olive-oil, linseed-tea, gruel, weak tea or coffee, warm water.

N. B.—The following are the poisons most commonly taken either accidentally or for suicide: Carbolic acid, oxalic acid, prussic acid, arsenic, fungi, lead, mercury, strychnine, opium, phosphorus, alcohol, tobacco, Paris green, spoiled food.

Special Poisons.	Their Symptoms.	Their General Treatment.
I. THE ACIDS. (*a*) The strong, corrosive ones, viz.: i. Acetic (glacial and aromatic vinegar). ii. Hydrochloric (muriatic acid or spirits of salt). iii. Nitric (aqua fortis). iv. Sulphuric (oil of vitriol).	Immediate burning pain in mouth, throat and stomach; vomiting may occur, followed by purging; skin and mucous membrane where touched destroyed; shock, exhaustion, and suffocation.	*Caution.*—Emetics not to be given; administer magnesia or chalk in warm water, frequently; give demulcents, lime-water and milk; if there is depression, give stimulants.
v. Carbolic (phenol).	The above symptoms, with the voidance of greenish or black urine, and the odor of acid in the breath; great depression.	Epsom salts, ½ oz. in 8 oz. of warm water; white of egg in water in large quantities; soap; no oil; stimulants freely; warmth to extremities.
vi. Oxalic (salts of lemon or sorrel; also called "acid of sugar"; mistaken for Epsom Salts sometimes).	Burning pain in stomach; cramp in legs; dark-colored fluid vomited; hacking cough and a feeling of constriction in the throat; purging; mouth sore and white; great shock; death may rapidly supervene.	*Caution.*—Avoid giving potash, soda, or ammonia, or carbonate of potassium, sodium, or ammonium; administer chalk and water, magnesia and water, or lime-water frequently; plaster (not Paris) or whiting; castor-oil, 1 oz.; stimulants.
(*b*) Prussic (hydrocyanic) acid may occur in oil of almonds, almond flavoring, peach kernels, bitter almond water, laurel water, cyanide of potassium, Scheele's acid.	Giddiness; staggering; insensibility; loss of power; eyes fixed, pupils dilated, and insensitive to light; limbs flaccid; skin cold, and covered with a clammy perspiration; pulse imperceptible; respirations gasping and panting; convulsions; with a fatal dose insensibility rapidly follows.	Fresh air; emetics (ipecacuanha or mustard); inhalation of fumes of ammonia; stimulants (sal volatile or spirits, by enema if necessary); hot and cold douche; artificial respiration to be kept up steadily, and friction of the limbs. (NOTE.—If life can be maintained for half an hour, recovery is almost certain.)
(*c*) Carbonic acid, or oxide, gas, coal gas or sewer gas, choke-damp or after-	Irritation of throat; headache; drowsiness; giddiness; singing in ears; loss of muscular power; lividity; hur-	Remove to fresh air; artificial respiration; smelling-salts; stimulants; cold to head and chest.

Special Poisons.	Their Symptoms.	Their General Treatment.
damp, charcoal fumes.	ried respirations; coma; death.	
II. ACONITE (Monk's-hood, Blue Rocket) and its alkaloids occur in aconite liniment, neuraline, etc.	Warmth at pit of stomach; tingling of mouth, lips, and tongue; feeling of constriction of throat; swallowing difficult; numbness of tips of fingers; loss of sensation; deafness; respirations shallow and feeble; convulsions; great prostration.	Emetics, then digitalis if at hand; stimulants freely; warmth to extremities; friction; patient to be kept strictly recumbent, and no pillow allowed under the head; artificial respiration if necessary.
III. ALCOHOL, as in rectified, proof, and methylated spirits, brandy, rum, whisky, gin, etc.	Giddiness; speech disordered; ideas muddled; inability to stand or walk; gait tottering; expression vacant; face flushed; lips livid; breath alcoholic (but this may be due to stimulant given for other symptoms); skin covered with sweat; pupils dilated and fixed, but may be contracted; convulsions; stupor; coma, and death.	Emetics; rouse the patient, and keep him awake; hot strong coffee, by mouth or rectum; alternate hot and cold douche; when patient has sufficient recovered, rest and warmth.
IV. THE ALKALIES, strong caustic ones, viz.: i. Ammonia (spirits of hartshorn, etc.), as in caustic ammonia, ammonia liniment, compound camphor liniment, liquid ammonia. ii. Lime, as caustic lime, quicklime. iii. Potash, as caustic potash. iv. Soda, as caustic soda, soda lye.	Immediate burning pain in mouth, throat, and stomach; vomiting and purging; great shock and exhaustion; suffocation.	*Caution.*—Emetics not to be given; vinegar, lemon or orange juice, tartaric or citric acid, in plenty of water; demulcents; stimulants if required. If power of swallowing lost, inhalation of acetic acid or vinegar from pocket-handkerchief.
V. ANTIMONY, as chloride or tartarated antimony, tartar emetic, antomonial wine, Hooper's or Holt's specific.	Metallic taste in mouth; nausea; vomiting; heat; constriction and choking in throat; pain in stomach; violent purging; cramps in limbs; skin cold; head and face congested; great depression and collapse.	Emetics; large draughts of strong tea or coffee; stimulants if patient in collapse; warmth to limbs and body.
VI. ARSENIC (arsenious acid, white arsenic) may occur in aqua tofana, fly-papers, mineral Vienna and Scheele's emerald green, Fowler's solution, Simpson's rat paste and vermin killers (Roth and Ringeisen's),	Faintness; depression; burning pain in stomach; nausea; vomiting; may be blood in vomit; purging; severe cramp in legs; constriction and dryness of throat; great thirst; hiccough· loss of voice; cold sweats; great shock and exhaustion.	Emetics, followed by plenty of warm water to wash out the stomach; dialyzed iron in ounce doses, or magnesia, frequently repeated, or plenty of a fresh mixture of tincture of iron chloride with calcined magnesia, washing soda, baking soda or ammonia water; or Jeannel's antidote; olive-oil

Special Poisons.	Their Symptoms.	Their General Treatment.
cheap ices, wall-papers, cheap crayons, and French chalks. Tinned fruits (as an impurity of the tin.)		and lime-water, in large doses, frequently repeated; stimulants freely, if prostration; demulcents; warmth and friction; after acute symptoms relieved, linseed poultices to abdomen.
Atropine—See Belladonna.		
VII. BELLADONNA (Deadly Nightshade) and its alkaloid atropine, in liniments, eye-drops, etc.	Heat and dryness of mouth and throat; great thirst; difficulty in swallowing; face flushed; eyes prominent, pupils dilated; excitement and noisy delirium; gait unsteady and staggering; skin dry, with perhaps a red rash on it.	Emetics; give tannic acid freely, if at hand; strong coffee enema; stimulants; mustard to calves of legs; hot-water bottles to feet; alternate hot and cold douche; artificial respiration.
VIII. CANTHARIDES (Spanish fly, blister beetle, blistering fluid).	Same as arsenic-poisoning.	Emetics; demulcents (avoid fats and oils); when acute symptoms relieved, hot baths or linseed-meal poultices to the abdomen.
IX. CAMPHOR, as in essence, liniment, spirits of camphor, Rubini's solution.	Odor of breath; languor; giddiness; faintness; delirium; convulsions; cold and clammy skin; difficult breathing.	Emetics; stimulants; warmth and friction to extremities; alternate hot and cold douche to head and chest.
X. CAUSTIC, LUNAR (nitrate of silver).	Pain and discoloration of mouth and throat; vomiting of whitish, flaky matter, which turns black.	Common salt, dissolved in water or milk, given freely; emetics, except sulphate of zinc; demulcents.
XI. CHLORAL (chloral hydrate, syrup of chloral, Hunter's chloral).	Deep sleep; loss of muscular power; face livid and bloated; pulse slow; respirations diminished; surface of body cold.	Emetics; warmth and friction; keep patient roused by shouting, striking him with wet towels, etc.; strong coffee enema, and repeat it if necessary; artificial respiration to be kept up if necessary.
XII. CHLORINE GAS, as in chloride of lime and other irritant gases.	Irritation of throat; cough; tightness of chest; difficulty of breathing; inability to swallow.	Fresh air; inhalation of steam; inhalation of very weak ammonia gas.
XIII. CHLOROFORM (inhaled). Bichloride of methylene, ethidene dichloride.	Arrested respirations; stertorous breathing; face livid.	Pull forward tongue; see mouth and throat are clear of mucus or phlegm; loosen everything about throat and chest; plenty of fresh air; hot and cold douche alternately to head and chest; place the patient head down (hang him over your shoulders by the knees); artificial respiration.
XIV. CHLOROFORM (swallowed).	Odor of breath; pain in throat, stomach, and over abdomen; great depression; insensibility; pupils dilated; breathing stertorous; skin cold; pulse imperceptible.	Emetics; carbonate of soda in plenty of water; rouse patient in every possible way; douche; friction; enema of strong coffee; demulcents.
Coal Oil—See Paraffin Oil.		
XV. COPPER, as the sulphate (blue	Metallic taste in mouth; constriction in throat and	Emetics (if no vomiting), followed by large draughts

Special Poisons.	Their Symptoms.	Their General Treatment.
vitriol, blue stone), the acetate (copperas, verdigris). *Corrosive Sublimate*—See Mercury.	gullet; pain in abdomen; vomiting; purging; difficult breathing; great weakness; thirst; cold perspirations; coldness of limbs; headache; giddiness; coma.	of tepid water; demulcents freely; poultices to abdomen if pain.
XVI. CROTON-OIL. *Cyanide of Potash*—See Acid, Prussic. *Deadly Nightshade*—See Belladonna.	Great pain in abdomen; vomiting; purging; watery stools; face pale and pinched; skin moist; great collapse.	Emetics; demulcents; stimulants freely; poultices to abdomen.
XVII. ERGOT OF RYE and its alkaloids, ergotine, etc.	Tingling and cramp of limbs; dizziness; weakness; retching; vomiting; diarrhœa.	Emetics; castor-oil 1 oz.; stimulants; warmth and poultices.
XVIII. ETHER (inhaled).	Same as chloroform inhaled.	Same as chloroform inhaled.
Foods, Spoiled—Tainted meat, milk, fish, spoiled ice-cream, canned goods, etc. *Fowler's Solution*—See Arsenic.	Nausea; vomiting; pains in abdomen, back and limbs; headache; purging; pale face; clammy skin; collapse.	Emetic; castor oil as a purgative stimulant.
XIX. FUNGI (fly fungus, poisonous mushrooms).	Violent colic, with vomiting and diarrhœa; great excitement, then coma; pulse slow; breathing stertorous; pupils dilated; extremities cold.	Emetics; strong coffee or brandy; castor-oil 1 oz.; ammonia to the nostrils; warmth to extremities; poultices to abdomen for warmth.
XX. HOLLY BERRIES.	Vomiting; pain in head and abdomen; purging; pupils contracted; drowsiness; unconsciousness; collapse.	Emetics; stimulants freely; friction; warmth; coffee enema.
XXI. HYOSCYAMUS (henbane) and its alkaloids, hyoscyamine, etc.	Much the same as belladonna—thirst; dilated pupils; delirium.	Emetics; stimulants moderately; coffee enema; hot and cold douche alternately.
XXII. IODINE and IODOFORM.	Pain and heat in throat and stomach; purging; vomited matter may be yellow or blue; stools may contain blood; giddiness; faintness.	Emetics; starch and water; arrowroot, or gruel, or white of egg and water, freely.
XXIII. LABURNUM and its active principle, *cytisine*, in arnica. *Laudanum*—See Opium.	Purging; vomiting; great restlessness, then drowsiness; insensibility, with convulsive twitchings.	Emetics; stimulants; moderately hot coffee enema; hot and cold douche alternately.
XXIV. LEAD, as acetate (sugar of lead). Lead paint or white lead may occur in crayons, French chalk, hair dyes.	Vary widely; generally much delayed; dryness of throat; metallic taste; great thirst; colic about navel, which is relieved by pressure; always constipation; cramp in legs; paralysis of lower extremities; convulsions.	Emetics; Epsom salts freely; demulcents; poultices to abdomen.
Lunar Caustic—See Caustic.		

Special Poisons.	Their Symptoms.	Their General Treatment.
Matches—See Phosphorus.		
XXV. MERCURY, as corrosive sublimate, perchloride of mercury, red and white precipitate, red oxide of mercury; the acid nitrate of mercury.	If corrosive sublimate or acid nitrate taken—lips and mouth white and swollen; tongue white and shrivelled; sense of constriction in throat. In all cases: metallic taste in mouth; pain in the stomach; nausea; vomiting of stringy mucus mixed with blood; profuse purging, with bloody stools; skin cold and clammy; respirations difficult; syncope; convulsions.	Emetics; raw white of egg mixed with water, given freely; demulcents; stimulants.
Morphine—See Opium.		
Mushrooms, Poisonous—See Fungi.		
XXVI. MUSSELS.	Weight at pit of stomach; numbness in extremities; heat, dryness and constriction in mouth and throat; thirst; shivering; difficult breathing; cramp in legs; swelling of eyes; colic; vomiting; purging; itching of skin; collapse.	Emetics; castor-oil 1 oz.; stimulants very freely; hot-water bottles to feet; warmth and friction.
XXVII. NITROUS OXIDE GAS (laughing gas).	Same as chloroform inhaled.	Same as chloroform inhaled.
XXVIII. NITRO-BENZOL, as in aniline dyes, liqueurs, sweetmeats, pomades.	Weakness; discomfort; nausea; great anxiety; confusion of mind; cyanosis often very marked; pupils dilated; may be convulsions.	Emetics; stimulants freely by mouth or enema; inhalations of ammonia; hot and cold douche alternately; artificial respiration.
XXIX. NUX VOMICA (St. Ignatius' Bean) and its alkaloid, strychnine, as in Butler's, Battley's and Gibson's Vermin Killer.	Violent rigid convulsions, which cease for a minute or two and come on with the slightest cause, such as a noise or touch; lockjaw during the convulsive attack, but not appearing as early as in true lockjaw or tetanus; pupils dilated; respirations impeded; pulse feeble; death from asphyxia or collapse (exhaustion).	Emetics; animal charcoal, followed by an emetic; artificial respiration if necessary; avoid noise of any kind; place under chloroform to prevent the convulsions. Bromide of potash; chloral.
XXX. OPIUM (laudanum) and its alkaloids (morphine, codeine, etc.) occur in tincture and wine of opium, Battley's Sedative Solution, Black Drops, Chlorodyne, Dalby's Carminative, Godfrey's Cordial and Elixir, Mother's Friend and Soothing Syrup, Nepenthe, Syrup of Poppies,	Excitement, followed by headache; weariness; a sensation of weight in the limbs; sleepiness; loss of sensibility; contraction of the pupils; at first difficult to rouse the patient; later on he becomes quite insensible; muscles become relaxed; skin cold; face and lips cold and blue; respirations slow, irregular, and stertorous.	Emetics; rouse and *keep the patient awake in every possible way* by making him walk about at short intervals, between two persons, but do not exhaust him; flap him with a wet towel, etc.; ammonia or sal volatile to nostrils. Do not give wine or brandy. *Strong hot coffee,* by mouth or rectum, should always be given; cold douche to head frequently. Artificial respiration to be kept up for at least two

Special Poisons.	Their Symptoms.	Their General Treatment.
Paregoric and Dover's Powder.		hours, but may be necessary for twelve hours.
XXXI. PARAFFIN-OIL (Coal-oil, Petroleum or Rock Oil).	Symptoms vary; odor of breath; burning sensation in mouth, gullet, or stomach; body and extremities cold; face pale; pulse feeble; respirations weak; great thirst; often coma.	Emetics; stimulants freely; warmth to extremities.
Paregoric—See Opium.		
Paris Green—See Arsenic.		
XXXII. PHOSPHORUS, as in matches, phosphorus paste, rat poison, roach poison, vermin killer, rat paste (Roth and Ringeisen's, with arsenic).	Pain in stomach; vomiting; vomited matter luminous in the dark; odor in breath; bleeding from nose; vomiting of blood; blood-stained motions; convulsions.	Emetics; Epsom salts, ½ oz. in water (avoid oils and fats); stimulants or demulcents if required.
Poisonous Plants—See Fungi, Tobacco, Belladonna.		
Prussic Acid—See Acid, Prussic.		
Silver Nitrate—See Caustic.		
Sugar of Lead—See Lead.		
Soothing Syrups—See Opium.		
Strychnine—See Nux Vomica.		
Tartar Emetic—See Antimony.		
XXXIII. TIN AND ITS SALTS.	Same as lead.	
Toadstools—See Fungi.		
XXXIV. TOBACCO and its active principle, nicotine.	Nausea; vomiting; great weakness; faintness; confusing ideas; dimness of sight; weak pulse; cold and clammy skin; pupils at first contracted and then dilated.	Emetics; strong tea; stimulants freely; warmth and friction; recumbency.
XXXV. TURPENTINE (oil and spirit of turpentine, "turps," camphene).	Odor in breath; intoxication; pupils contracted; stertorous breathing; coma; collapse; convulsions; frequent desire to pass water. Some resemblance to opium poisoning.	Emetics; Epsom salts, 1 oz. in water; demulcents.
XXXVI. ZINC, as sulphate (white vitriol), chloride (Burnett's fluid).	Lips and mouth corroded; pain and burning in throat and mouth; vomiting of blood-stained fluid; difficulty in swallowing; pulse and respirations quick; pupils dilated; convulsions; coma.	Bicarbonate of soda, or common soda, in large quantities, dissolved in warm water; demulcents freely; strong tea; poultices to abdomen; gruel enema, if pain; avoid common salt.

A fuller discussion of the treatment of the **commonest forms of poisoning** is given below:

Acute Alcoholism.—As the result of taking excessive quantities of alcohol, various degrees of poisoning are brought about, from the slighter effects which are sufficiently familiar, to the more severe condition in which the patient becomes absolutely unconscious, and in which actual danger to life may exist. For convenience the slighter degrees of poisoning may be spoken of as **drunkenness,** whilst the

Fig. 203. Castor oil plant, *Ricinus communis.* a. Fruit. b. Flower. c. Seed or bean.

stage of insensibility may be called **acute alcoholic coma.** The former is not in itself dangerous, and usually the best course to take with drunken men or women is to leave them to sleep off the effects of the alcohol. Nevertheless, even a moderate grade of drunkenness may be dangerous in old or feeble people, with degenerated tissues and weak circulation, for it may be the cause of a grave cerebral disturbance (generally of the nature of an apoplexy), or of a failure of the heart's action. The latter event must be particularly guarded against in cold weather, for, in consequence of the dilated condition of the arterioles of the skin, drunken people lose heat very quickly. Care must be taken, therefore, in thus leaving drunkards alone, that their conditions are such that there is no chance of their getting dangerously cold.

It often happens that it is desirable to make a patient sober as soon as possible. For this purpose nothing is more effectual than a

brisk **emetic.** Twenty grains of zinc sulphate may be conveniently used for emesis. If the patient be violent or refuse the draught, it may be given with the stomach tube (the uses of which are described later); but in practice it will be found that if the pump has to be used at all, a sufficiently sobering effect will be produced by washing the stomach out with two or three pints of warm water. In certain cases, a hypodermic injection of one-tenth to one-eighth of a grain of apomorphia

Fig. 204. *Ergot* or *Spurred Rye.* The grains of rye in this head are affected by a parasitic plant which blackens the grains. Wheat, oats and barley are also subject to it. This parasitic plant is a fungus and contains a substance which is medicinal in small doses, but poisonous in large or repeated doses. It causes the small arteries to contract and gangrene results from the consequent lack of blood. Rye bread is sometimes poisonous in this way and cattle may be poisoned by ergot.

may be administered. Great care should be used, however, in administering this drug, as its use is sometimes followed by alarming depression. It should only be used for strong adults with good pulse, and only by a doctor.

A short experience will enable any one to separate ordinary cases of drunkenness from other forms of poisoning, and we need not particularize its symptoms. It is undesirable also to attempt a hard and fast differential diagnosis between the higher grades of acute alcoholism and other grave conditions, such as **apoplexy, concussion of the brain** and **opium poisoning.** Whatever the difficulties, we shall avoid falling into very serious error by remembering that even if the condition is brought about by alcohol, it is now not an alternative question, drunk? or dying? but a positive statement, drunk **and** dying. **Any patient who has swallowed enough alcohol to produce symptoms which may be confounded with apoplexy or any other severe illness must be considered to be poisoned, and to be in need of careful treatment.**

In these cases of acute alcoholic poisoning, the condition of the circulation and respiration will be the best guide as to whether the patient may be left to recover from his stupor without further measures beyond those which are required for keeping him warm, or whether the stomach pump should be used; but in most cases it will be best to wash the stomach out with warm water, and this should always be done if there be any sign of failure of the heart's action, or

Fig. 205. *Green Sneezewort. a,* Fruit; *b,* seed.

Fig. 206. *Black Sneezewort.*

if the breathing be suspiciously shallow. Alcohol may remain for a long time nearly unchanged in the stomach, and should therefore be removed to prevent further absorption. In extreme cases, artificial respiration may be called for, but such cases are generally speedily fatal.

If the stomach pump (or tube) be not at hand, emetics may be used, but as it is undesirable to further irritate the already injured stomach, preference should always be given to the pump if possible. The irritable condition of the stomach should always be kept in mind in the treatment of the case after the acute stage has passed.

Intoxication by drinking **ether** is hardly known in America, but is said to be common in some parts of Ireland. As a result of inhalation, it is of daily occurrence in all hospitals. When it is swallowed, its effects nearly resemble those of alcohol, but the period of excitement is more marked, and that of stupor less so. It is much more rapidly eliminated, so that the whole intoxication is shorter, and less poisonous, although Dr. Morshead, of Draperstown (the headquarters of

ether drinkers), recorded four fatal cases. Its treatment does not differ from that for alcoholic poisoning.

Almost the same may be said of a form of poisoning now common, namely, by **kerosene** or some mineral oil. When this is swallowed it produces flushing and excitement, followed by drowsiness. In these cases the major part of the oil is generally vomited spontaneously, but the stomach-pump should in all cases be used, or failing that, an emetic should be given.

Poisoning by Opium, or by its alkaloids, is very common, and is getting more so, not from any increase of suicide by this means, but

Fig. 207. *Spotted Hemlock.* *a*, Fruit; *b*, Flower.

Fig. 208. *Cookshell.* *a*, Single seed; *a'*, group of seeds.

from the numerous instances of inadvertence occurring in the growing class of people who have acquired the habit of administering the drug to themselves.

When opium is taken for suicidal purposes, laudanum is generally employed, and it often happens that the suicide swallows a very large quantity. This very frequently leads to failure of the attempt through the active vomiting which is set up.

The symptoms of opium poisoning are generally distinct enough. The slow, shallow respiration and feeble, fluttering pulse; the pallid, almost livid skin covered with a cold sweat; the obstinate drowsiness or profound stupor, and above all, the fixed contracted pupils, are sufficient evidence of the condition, even without any external or circumstantial proofs.

In this condition the respiratory center is the part in greatest danger of stopping work, and it must be kept going until the poison has been eliminated. By every possible means the patient must be roused, and kept awake after the stomach has been washed out. Generally a good plan is to keep him walking about, supported, if necessary, on either side, while by shouting, slapping the face or chest with a wet towel, etc., every effort must be made to prevent a relapse into torpor. (But the frequent application of the faradic current is the best means of preventing torpor, as it is far less exhausting to all concerned. The nitrate of amyl may be inhaled with advan-

Fig. 209. *Meadow Saffron* or *Colchicum*. *a*, Fruit, cut across; *b*, the whole plant, in bloom.

Fig. 210. *Daphne mezereum*. *a*, Fruit; *b*, flowers.

tage.) It is very important that the patient be kept warm. It is important also not to unnecessarily exhaust the patient. This is easily done, since there is so much depression and weakness in opium poisoning.

If the patient be very torpid the stomach tube should be passed and the stomach washed out with a solution of potassium permanganate, two teaspoonfuls to a pint of water, until the washings return clear. Some of the solution should be left in the stomach, and more of the permanganate administered every hour for a few hours.

(If, in spite of these efforts, the stupor deepens, and the respiration further fails, faradization of the diaphragm may be tried; the

surgeon must be ready to adopt artificial respiration, and may consider the advisability of administering the only drug which is believed to have an antagonistic action to that of opium, namely, **atropine.** Opinions as to the truth of this antagonism are very contradictory;

Fig. 211. The stomach tube. It is of stout rubber tubing and has a mark to show how far to insert it. Water (or liquid food) is poured in the funnel while it is raised to a height. If it is desired to empty the stomach, the funnel end is lowered, as shown by the dotted line; the tube then acts like a siphon, or the patient may strain as if to vomit, which will force the stomach contents out.

some holding the fact to be indisputable, while others state that its administration actually intensifies the poisoning. On the whole there seems to be sufficient evidence for the antagonism to justify the administration of the drug in extreme cases. The most convenient form will be by hypodermic injection of atropine sulphate solution, 4 or 5 m (1-25th to 1-20th gr. of the alkaloid), of which might be given for a dose, to be repeated, or slightly increased, if the symptoms seem to be improving under it.)

When improvement has once commenced it is generally continuous. The pupils may remain contracted for a long time, but when the respiration and circulation appear to be well established, and the patient is able to keep himself awake, the best treatment will be warmth in bed, when natural sleep will probably soon come on and may be encouraged. The patient should be watched, however, lest the respiration should again begin to fail and other symptoms of poisoning redevelop. Alcoholic stimulants seem to be hurtful in all stages of the poisoning.

Strychnine Poisoning.—This alkaloid is a common ingredient of "vermin powders," "beetle paste," and the like, so that strychnia poisoning by misadventure is rather frequent. The symptoms of this condition can only be mistaken for those of acute tetanus, or true lockjaw, and this error can hardly be made if attention be carefully given to the case for a short time. The condition is, of course, a "tetanus" in both cases, i. e., there is continuous contraction of the muscles; but in that of the poisoning, the **rapid development** and

acuteness of the attack, the **universality of the convulsions,** as opposed to the almost invariable spreading from the neck and jaw muscles in the ordinary tetanus, the **nearly complete relaxation in the intermittent periods,** and the fact that the **duration of the whole attack** is to be measured by hours—all these will enable a diagnosis to be made with almost absolute certainty, although indeed this is of the less importance in that the treatment may be much the same in either case.

In strychnia poisoning there is a very short period of abnormal restlessness, quickly followed by a general trembling, and then com-

Fig. 212. *Strychnine plant, nux vomica.* The "bean" or seed is poisonous.

Fig. 213. *Gelsemium* or *yellow jasmine.* *a,* Fruit.

plete opisthotonos (or contraction of the back muscles so that the victim bends backward very markedly), with marked "risus sardonicus" (a peculiar grin), and cyanosis (blueness of face and hands). In half a minute, or a minute, the spasm relaxes, and there is a period of exhaustion and respite, to be succeeded on the slightest irritation, or apparently without any cause, by a similar storm of reflex contraction. If death occurs, it will generally be from stoppage of the breath or from exhaustion, and will very often take place in less than an hour. If the dose has not been a fatal one, the spasms will gradually diminish in frequency and force. In the treatment, the main reliance must be placed upon **inhalations of chloroform,** and large and frequently repeated doses of **chloral hydrate** and **bromide of potassium.** Nitrate of amyl may be inhaled ("and artificial respiration, if

possible, performed, Murrell"). If by any means the first few hours can be tided over, hopes of recovery may be fairly entertained. If the form in which the poison has been taken be rather a bulky one, as a vermin poison, then in the first instance the stomach tube must be used, chloroform having been first administered; or a brisk emetic, e. g., one of sulphate of zinc, or of mustard and water, must be very promptly given; or ⅛th of a grain of apomorphia may be injected subcutaneously.

Belladonna Poisoning.—This is generally accidental, as from eating the berries of the "Deadly Nightshade" (Atropa belladonna), swallowing lotions containing atropine, or through some similar mistake. The symptoms are very characteristic. The pupils are widely

Fig. 214. *Black nightshade, bittersweet.* *a*, Fruit; *b*, flower. The berries are poisonous.

Fig. 215. *Deadly nightshade, atropia belladonna.* *a*, Fruit; *b*, flower.

dilated, and the skin capillaries injected, producing a rash like that of scarlatina. There is much cerebral excitement, the delirium is generally chattering and restless, but may be extremely violent. The mouth is always parched, and the skin very dry.

Emesis must be produced by the stomach pump, or by sulphate of zinc, etc., or by apomorphine 1-10 grain, and following this stimulants should be given in the shape of alcohol or ether, as well as strong tea or coffee, which are also useful from the tannin they contain. Artificial respiration may be necessary in very severe cases, and in others, external stimuli, such as the douche, etc.

(Both morphia and chloral have an antagonistic action to atropia,

but this is in neither case so distinct as that of **pilocarpine,** ¼ to ½ grain of which should be injected subcutaneously, and repeated if sweating be not produced. Five to 10 m of a 1 in 20 solution of the alkaloid, or its hydrochlorate, or two teaspoonfuls of the tincture of Jaborandi will be the doses required.)

Retention of urine is common in these cases, calling for the use of the catheter. In any case the bladder must be frequently emptied, so that the poison may not be reabsorbed.

Prussic Acid Poisoning.—The action of hydrocyanic acid is so intense that death is often almost instantaneous, or there may be just

Fig. 216. *Aconite, wolfsbane* or *monkshood. a,* Fruit; *b,* flower. The whole plant is poisonous and the root is sometimes mistaken for horse radish.

Fig. 217. *Spurge.*

time enough for a cry of agony. Even in less acute cases the symptoms come on within a few minutes. There is first respiratory difficulty, and then a period of violent convulsive movements, which are general throughout the body but especially affect the expiratory muscles. Vomiting and involuntary urination and defecation occur. This stage is followed by a period of calm, with rapidly deepening paralysis and cyanosis. This is usually quickly followed by death. In fact, the whole attack resembles an acute asphyxia, or rather is one, and although treatment is rarely successful, it must be directed

towards maintaining the action of the respiratory center in every possible way.

Should there be time for any attempts at restoration, an emetic should be given, or the stomach pump used, if it can be employed **at once**; then ammonia on a handkerchief, as strong as can be borne by the patient, should be inhaled, and other stimulants freely given by the mouth if they can be swallowed; if not, then brandy and ether should be given hypodermically. Stimulant enemata may also be employed. Alternate douches of cold and hot water are powerful stimuli to respiration (and strong faradization should always be

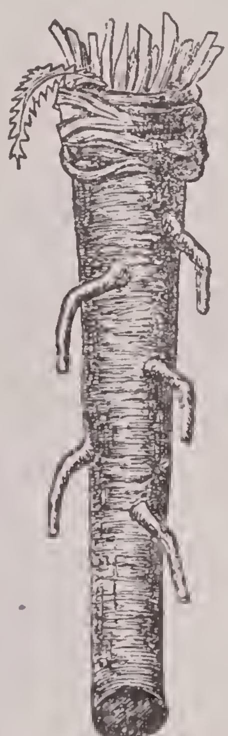


Fig. 218. The root of horse radish. Aconite root looks somewhat similar, but is poisonous.

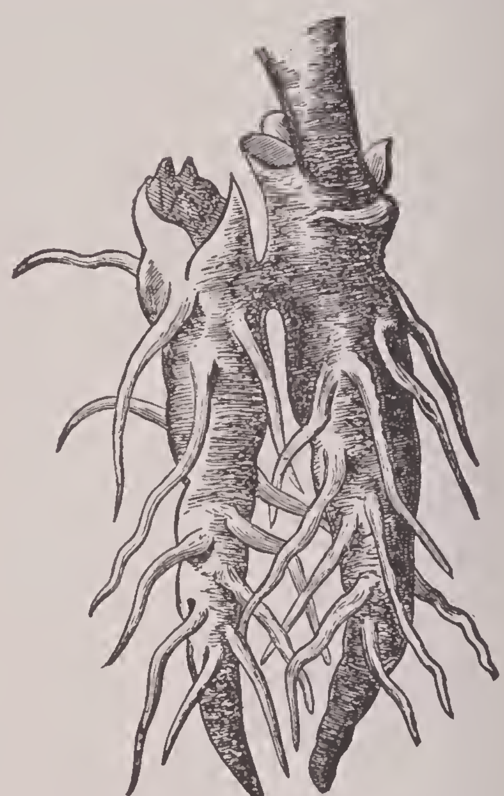


Fig. 219. Aconite root. It is *poisonous* and is sometimes mistaken for horse radish.

applied if possible). Artificial respiration will most probably be called for as soon as the convulsive stage is over, and must be persevered in, although the condition may seem to be almost hopeless.

The materials used for prussic acid poisoning are usually either impure bitter almond oil, or the pharmacopœial, or "Scheele's" acid, or some one of the soluble cyanides so largely used by photographers.

The only substance which at all resembles it in its action is **nitrobenzol,** or artificial oil of bitter almonds, nor would the treatment of poisoning by the latter differ in any respect.

Chloral Poisoning.—As in the case of opium poisoning, this is

generally a poisoning by misadventure, due to the increasing habit of self-administration of drugs by the laity. The symptoms resemble in great measure those of opium poisoning, but the fixed contraction of the pupils is absent, and the circulation is affected quite as much as the respiration.

In all respects of rousing, emetics, etc., the treatment is the same as for opium, and so also with regard to hot and cold douches and artificial respiration. It is even more important than in opium poisoning that warmth should be kept up, and the administration of a pint of very warm strong coffee by the rectum will supply warmth and stimulation.

Fig. 220. *Water Hemlock* or *Cowbane,* whose roots are poisonous.

Fig. 221. *Hound's Parsley.* The root is poisonous.

(With regard to an antagonist, the most distinct one is strychnia; 4 drops of the strychnine solution may be injected beneath the skin, and repeated every ten or twenty minutes if necessary.)

The irritant and corrosive poisons may conveniently be grouped together, for the symptoms of the latter only differ from the former in their greater intensity. Moreover, many of the substances in our list in weaker solutions are irritant poisons and corrosive poisons when concentrated. In most cases the local effects are so marked that any constitutional results of their absorption are unnoticed.

The following is the general sequence of events after an irritant poison has been swallowed. There is first a **burning metallic taste in the mouth and throat,** and then a sense of **intolerable pain referred to the chest** behind the sternum (heartburn). This is followed by **increasing general abdominal pain,** so that the legs are drawn up, as

in peritonitis, and the belly becomes tumid. **Vomiting is almost invariably present,** and there is generally **great thirst.**

If the poison has been taken in a quantity insufficient to cause speedy death, and if it be **irritant** only, and not corrosive, the above are the chief symptoms. In the less severe cases these may, with appropriate treatment, be subdued; on the other hand, if the dose be a fatal one, the symptoms of irritation will quickly be followed by distressed breathing and increasing collapse, so that the patient looks to be in the cold stage of cholera, and this will continue until death occurs.

Fig. 222. *Poison Sumach.*

Fig. 223. *May apple* or *mandrake.* The root is poisonous.

But if the substance be truly **corrosive** in its action, such as one of the concentrated mineral acids, the symptoms are even more severe, and run a much more acute course; it is probable that no recovery has ever taken place after such a poison has been swallowed, so that any quantity has passed into the stomach, although instances are common of great damage to the throat and œsophagus being followed by recovery; or, we should rather say, by recovery in the first instance, for generally the consequent scarring has led to contraction and stricture of the gullet.

The damage to the lips and throat is the first and most prominent symptom, and gives the measure of the extent of the corrosion of the parts lower down. The corners of the mouth will be marked, and the tongue and palate covered with a whitish coat of slough, "like

a coat of paint," if hydrochloric acid or corrosive sublimate has been used; blackish in the case of sulphuric acid; or with a yellow stain, in the case of nitric acid.

In the presence of these signs of corrosion a very few minutes will decide whether the poison has been really swallowed. If so, the symptoms which have just been detailed will develop, but more rapidly and more acutely. The stage of collapse is reached more quickly, and there are signs of actual destruction of the viscera. The vomit contains shreds of sloughing mucous membrane, or it may be, casts of whole sections of the œsophagus. The abdomen becomes

Fig. 224. *Jamestown weed, thorn apple* or *stramonium.* Its seeds are poisonous. *a*, Fruit; *b*, flower.

Fig. 225. *Black Henbane.* *a*, Fruit, with cap; *b*, flower.

enormously distended with gas. Difficulty of breathing and of swallowing is intense, and death usually occurs within a few hours.

In many respects the treatment of poisoning by irritant or corrosive substances is common to them all; and again, with regard to many, there are some particular antidotal drugs, or some special measures to be taken or avoided.

In the first place, the stomach-tube should be used, unless there be evidence of such corrosion as to make it probable that the walls of the œsophagus or stomach are too much damaged for the tube to be safely passed. Such a case is indeed practically hopeless from the first, unless the damage be confined to the upper part of the canal.

The vomiting, which is almost always present, should be encouraged by giving warm water; and, failing the stomach-pump, the

natural emesis may be encouraged by mustard and water (or by the hypodermic injection of apomorphia).

As soon as the stomach has been relieved of the poison, raw egg albumen, milk, barley water, arrowroot, or whatever mucilaginous fluid can be most readily procured, should be given. Egg albumen, raw, is probably the best in all cases, as well as having a special action on corrosive sublimate. Salad oil may generally be given with good results, except in the case of phosphorus poisoning. The rest of

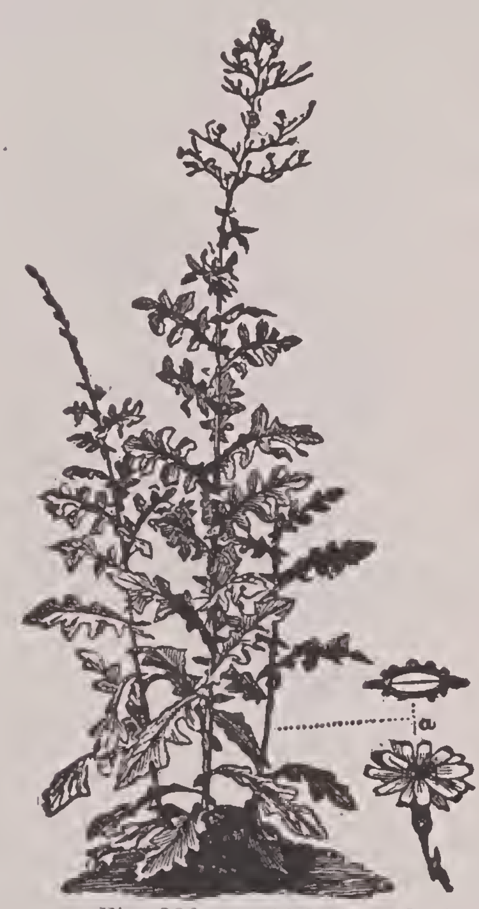


Fig. 226. *Acrid lettuce, lactuca virosa.* *a*, Flower (below) and cross-section of the fruit (above).

Fig. 227. *Red foxglove* or *digitalis.* A powerful poison and drug acting on the heart. *a*, Fruit; *b*, flower.

the general treatment of irritant poisoning will be directed towards the symptoms of peritonitis and collapse. The pain must be subdued with full doses of opiates. The warmth of the body must be maintained, and the other signs of shock combated by such stimulation as is afforded by the inhalation of ammonia, the subcutaneous injection of ether and brandy, stimulant enemata, etc. Morphia by hypodermic injection will also generally be useful.

Special points in the treatment of particular irritant and corrosive poisons:

I. **For Irritant and Corrosive Acids.**

These comprise sulphuric, nitric, hydrochloric, oxalic, and carbolic acids; the symptoms in the case of the first three will be similar, and in accordance with those results of swallowing any corrosive fluid which have just been described. The acuteness of the symptoms will vary **directly with the strength of the solution,** and **inversely with the quantity of food** in the stomach. In all, if a strong solution be actually swallowed, the symptoms will be of the most urgent kind, and will be rapidly fatal if not at once counteracted, so that **time is of the utmost importance.** The stomach pump may not safely be used

Fig. 228. *Smilax* (Paris quadrifolia).

Fig. 229. *Indian turnip, jack-in-the-pulpit* or *Aaron's rod.* *a*, Fruit; *b*, flower (without its hood).

unless the acid has been in quite a dilute solution. The charring in the case of nitric acid is yellow, and the vomit possesses a nitrous smell. In sulphuric and hydrochloric acids, the lips and mouth are whitish, and the vomit dark or black, containing charred shreds of mucous membrane. Very strong sulphuric acid blackens the tissues.

The treatment lies in **diluting and neutralizing the acid as quickly as possible,** so that all remedies should themselves be copiously diluted. Lime water (the saccharated is the best), whiting and water, **chalk** and water, soap and water, ordinary washing soda, or the **bicarbonates** of soda or potash, or any of the preparations of magnesia, in solution, are all useful alkaline remedies. Some of them will almost certainly be at hand in any given case, and it should always be borne in mind that **"the nearest remedy is the best."**

In addition to alkalies, milk, olive oil, and the other demulcents mentioned above are all useful.

In poisoning by **oxalic acid** or by **salts of sorrel** (the acid oxalate of potash) the main special point to bear in mind is that the alkaline oxalates are soluble and poisonous, so that chalk, whiting, lime water, or magnesia must be used to neutralize the acid (forming the **insoluble** calcium or magnesium oxalate), and not soda, potash, or ammonia, or the carbonates of any of these (which form **soluble** oxalates). Oxalic acid poisoning is rather common and is frequently suicidal. The symptoms are those already detailed, save that collapse is often disproportionately marked, and that death may be very speedy.

Carbolic acid poisoning is a common form of poisoning by misadventure and is also used for the purposes of suicide. Its corrosive action is, in concentrated solutions, very conspicuous, but the destruction does not extend deeply into the tissues. The mouth and jaws are usually covered with a white leathery pellicle. The symptoms are those of poisoning by any corrosive fluid; but pain is even more intense than in the case of the other acids, while on the other hand the collapse and other symptoms of the gravest local injury are not so manifest, nor is the whole course of events after the poison has been taken so hurried.

Treatment.—The sulphates of magnesia or soda have generally been recommended on the supposition that sulpho-carbolates are produced. This, however, is very doubtful; and if it were so they are soluble. Albumen should be first given in the form of white of egg, as it forms an insoluble compound; then the stomach should be washed out with a weak soda solution by means of the tube, some of the solution being left in. In the absence of the stomach tube, vomiting must be produced by zinc sulphate, mustard and water, ipecacuanha, or the injection of apomorphia. Later on demulcents, such as barley water, olive oil, etc., may be given, or an ounce of castor oil.

Shock is often very marked, and must be treated by frictional warmth, ammonia, etc., as before stated. If there be much restlessness **chloral** should be given, as there is an antagonism between it and carbolic acid.

The urine is often dark and scanty, and may be suppressed, in acute carbolic acid poisoning. The carboluria (or carbolic acid urine) is then a grave symptom; but it often happens in surgical cases

that carbolic acid, not necessarily used in very large quantities, is absorbed and produces a similar inky urine.

II. For **corrosive sublimate** (perchloride or bichloride of mercury) the **acid nitrate of mercury,** etc., albumen in any shape (even gluten of flour is better than none, but white of egg is best) should be freely given, as an insoluble albuminate is thus formed. Emesis should be encouraged by warm water or mustard and water if vomiting be not active without such aid. If the solution has been concentrated the stomach pump must only be used with great care.

III. **Arsenical poisoning** is generally effected by arsenious acid (white arsenic), and is frequently given with criminal intent. The symptoms do not come on immediately after taking the poison. The vomiting and purging resemble at first an intensely violent bilious attack; afterwards the symptoms are more like acute cholera, and the diagnosis is often very hard to make. The emesis must be encouraged, and the stomach emptied by the pump. This should be followed up with oil, switched eggs, or a mixture of oil and saccharated lime water. Magnesia is also very useful, but the substance which best neutralizes the action of arsenic or arsenious acid in solution is the freshly prepared hydrated peroxide of iron. This can be quickly made by adding half an ounce of common carbonate of soda to a fluid ounce of tinct. or liq. ferri perchlor, and filtering. As a substitute, dialysed iron in ounce doses may be given.

If the diagnosis of the acute form of this poisoning is not generally easy, that of chronic arsenical poisoning is always difficult, but this condition does not fall under the heading of emergencies.

IV. **Poisoning with antimony,** in the form of tartar emetic.

The symptoms come on quickly, and generally the vomiting is so violent that the whole of the poison is soon ejected. If not, the symptoms resemble those of arsenical poisoning, but there is more depression. The treatment is the same as in arsenical poisoning; but in addition, **tannin** should be given in the form of very strong tea or coffee, or by means of preparations of oak or cinchona bark, or of tannic acid itself.

V. **Poisoning with Phosphorus.**—This is usually taken in the form of beetle paste, or rat paste, or sometimes by swallowing the heads of lucifer matches. In these cases the symptoms declare themselves soon after the poison has been taken, and are generally prolonged over days or it may be weeks. The prominent symptoms are great thirst, with heartburn and violent vomiting, the vomit being

phosphorescent in the dark and the breath smelling strongly of the poison.

The result will mainly depend on whether the vomiting be sufficiently active to prevent an absorption of a really poisonous amount. If the quantity absorbed be large, the symptoms remain acute; vomiting of blood and bloody purging are often present, with cramps, and finally coma. But if only a small, but still poisonous quantity has been taken (say ½ to 1 gr.), after the first indications of irritation have passed over, the symptoms usually subside for a day or two, and then the signs of acute atrophy of the liver begin to declare themselves. Then the jaundice deepens, and a comatose, typhoid condition, with delirium, generally ends in death in a few days, although in some of the milder cases recovery may take place. The early treatment of the poisoning does not differ from that of other irritants, saving that **oil (in which phosphorus is soluble) should never be employed** with the idea of soothing the intestinal mucous membrane. After the stomach has been emptied of its contents, either naturally or with the stomach pump, mucilage, magnesia in barley water, or similar demulcent fluids may be given. The only drug which seems to have any action in preventing the liver changes is the French oil of turpentine in full repeated doses of 15 drops to half a teaspoonful.

Chronic phosphorus poisoning, phosphorus necrosis, etc., cannot here be discussed, as they do not occur as emergencies.

VI. **Poisoning by Caustic Alkalies and Their Carbonates.**—This form of poisoning is rare, but potash or soda lye is sometimes taken. The symptoms are those of ordinary irritant poisoning, except that violent purging is generally a prominent symptom. In the treatment, the question of the use of the stomach-tube must be decided by the amount of caustic destruction. Weak acids, such as vinegar and water, or any of the dilute non-poisonous acids, should always be given.

Poisonous Foods.—A form of acute gastro-intestinal irritation, often so severe as to justify the term poisoning, is not infrequent as a result of eating shell fish, especially mussels.

In the treatment, an emetic should be given in the first place, and afterwards a full dose of castor oil with 20 to 30 drops of laudanum, chlorodyne, or of some similar sedative. This is to be repeated if necessary. (Atropine is here also indicated, although not so distinctly as in the case of poisoning by muscarine. The manner of administering, and the dose, are the same as in the following case.)

Mushroom poisoning is important, although cases are rare in large

cities. Most fungi, edible or inedible, may produce, if improperly cooked, symptoms of a mild degree of irritant poisoning, similar to those which have been mentioned, and which may be treated in a similar way. But cases of true **muscarine** poisoning exhibit a much higher grade of toxic symptoms. The fungi which contain muscarine or some similar alkaloid are not very numerous, the principal one being the fly fungus (Amanita muscaria). When the more actively poisonous fungi have been eaten, as a rule great cerebral excitement is caused, in addition to the more strictly irritative effects on the alimentary tract.

(Whenever the symptoms of mushroom poisoning are grave, and especially if there be delirium or mania, atropine should be given, say 3 to 5 drops of the solution by mouth, or 4 drops subcutaneously; or as an alternative treatment, full doses of the tincture or infusion of digitalis may be administered. In other respects the treatment should consist in removing the poison from the alimentary tract as soon as possible, by means of emetics, etc., and in allaying the irritation by demulcents.)

On the Washing Out of the Stomach, and on the Use of the Stomach Tube.

The use of the stomach tube in cases of poisoning has been already several times alluded to, but it is employed on many other occasions as well, as for the feeding of refractory patients, or in the treatment of some forms of dyspepsia.

The flute-key stomach pump was formerly much used; but the simple apparatus represented has almost entirely superseded it. This consists of a wooden mouth gag, and of a long, stiff india-rubber œsophageal tube to which a funnel is attached. The fluid is poured into the funnel when raised. Then the funnel end is lowered below the level of the stomach, when the fluid runs out again by siphon action. The process can be repeated as often as necessary. The tube must be sufficiently stiff to pass easily.

The important point in the use of the stomach tube is its insertion. In restless or refractory patients it will be necessary to use a gag, and although almost any form will do, the best is a piece of hard wood, of such a size that it will lie across the mouth between the front molar teeth, and it should be broad enough to allow of a hole being bored through its center, through which the tube can be passed.

In other cases no gag is required, and then the tube, which is made of india-rubber, can be passed with the right hand and guided by the

left forefinger through the pharynx and down the gullet with much greater ease. As soon as the end of the tube enters the œsophagus the choking usually stops. Supposing the case to be one in which the removal of something hurtful from the stomach is the object of the operation: after the tube has been passed, not less than half a pint of warm water or of some special fluid must be injected into the stomach before anything is allowed to return. The stomach may then safely be emptied, and the process of injection and syphonage repeated until the object is attained.

In case of poisoning, a pint of water, or of some bland, soothing fluid, should be left in the stomach; as also in the case of simple drunkenness, unless it be desired to leave an emetic injection instead. If, however, the pump has been employed for the purpose of washing the mucous membrane and removing the fermenting secretions of water-brash or similar forms of dyspepsia, only that amount of fluid should be left behind which the pump will not readily remove.

INSTRUCTION TWENTY-EIGHT—*Insensibility and Fits*

Subject Reference

For Narcotic Poisoning, see Vol. 1, page 477.

For Apoplexy, see Vol. 2, pages 446 to 447.

For Delirium Tremens, pages 438-442.

For Freezing or Frostbite, see Vol. 2, pages 32, also 630.

For Sunstroke, page 371.

What To Do in Case of Fainting, Shock, Apoplexy, Alcoholic Intoxication, Narcotic Poisoning, Sun-Stroke, Freezing

FITS: Epileptic—Hysterical—Electrical Shock.

Insensibility.

Complete loss of consciousness may be produced by any of the following causes:

1. Syncope or fainting.
2. Asphyxia.
3. Shock and collapse.
4. Concussion of the brain.
5. Compression of the brain.
6. Apoplexy.
7. Alcoholic intoxication.
8. Narcotic poisoning, as opium-poisoning.
9. Sunstroke.
10. Freezing.

Unconsciousness is also present in the following:

1. Epilepsy.

2. The convulsions of children.

3. Uremia (poisoning from waste substances which accumulate in the blood in kidney disease).

But here the most prominent feature is the presence of convulsions, and these diseases are dealt with separately under Fits.

Test for Insensibility.—To determine if a person is insensible, raise the eyelid and touch the white of the eye gently; if he does not blink he is insensible for he cannot resist doing so if conscious.

1. **Syncope or Fainting—Causes.**—Mental emotion, extreme exhaustion (as from hunger, fatigue, etc.), hemorrhage, cold, heat (particularly if combined with a close atmosphere, as in heated rooms, large crowds, etc.), constriction of the chest (as in tight-lacing), and organic disease of the heart.

Symptoms.—Fainting is generally ushered in by a feeling of giddiness and fluttering at the heart; the face then suddenly becomes pale and the lips white; the pulse is weakened and the breathing quickened; a cold sweat appears on the brow, and the patient staggers and falls to the ground in an unconscious state.

Treatment.—As fainting is caused by a diminution of the supply of blood to the brain, the object to be aimed at in treatment is to restore the cerebral circulation; therefore, when a person has fainted, do not attempt to place him in a sitting or standing posture (as this will only embarrass the already weakened action of the heart, and may be fatal), but lay him flat on his back or on his left side, with his pelvis and feet slightly raised, loosen all tight clothing about his body and neck, give him plenty of fresh air, sprinkle cold water in his face, apply smelling-salts to his nostrils; when he is able to swallow, give him a glass of water, or a little brandy, whisky, or sal volatile and water, and keep him lying down flat for some time.

If the faint is prolonged, and loss of consciousness does not return, send for medical assistance, but in the meanwhile apply warmth to the feet, a hot mustard-plaster over the heart, and, if the natural breathing has not returned, perform artificial respiration.

In a crowded room, a fainting-fit may be prevented by placing the patient in a stooping position on a chair, and bending his head between his knees. He must be supported as he might faint and fall forward on his head. If the patient has completely fainted away, this treatment is not to be attempted, as it only helps to obstruct the circulaion and the respiration.

2. **Asphyxia.**—This has already been treated.

3. **Shock or Collapse—Causes.**—Severe injuries or emotional disturbance, causing a profound depressing effect upon the central nervous system.

The injuries most liable to produce shock are:

(i) Those involving large surfaces of the skin, as in burns and scalds.

(ii) Those causing crushing or tearing of the body, such as occur in machinery and railway accidents.

(iii) Those affecting the abdominal organs.

Loss of blood and exposure to cold intensify the condition of shock.

Symptoms.—A person in a state of shock presents the following appearance: He lies flat on his back, his limbs are flaccid and he makes no spontaneous movements, his body is cold and clammy, his face pale, his eyes sunken, his pulse small, feeble and irregular, his respirations shallow, feeble and sighing, his temperature about 97°, or a degree or two lower, and consciousness more or less impaired.

Should a case of shock recover, a condition known as "reaction" comes on; the patient usually vomits, his pulse becomes stronger, his body warmer, and color returns to his face.

Treatment.—The object of treatment here is to bring about reaction by the application of warmth and the administration of stimulants. Therefore place the patient in bed as soon as possible between blankets, keep his head low, apply hot-water bottles to his feet and between his thighs, and apply friction to his arms and legs. If able to swallow, give him small quantities of stimulants, frequently repeated, till reaction shows itself, then lessen the stimulants, so as to avoid over-stimulation. If during the state of collapse the breathing should become embarrassed, perform artificial respiration.

4. **Concussion of the Brain—Causes.**—Usually due to blows, or falls upon the head, or falls upon the feet or lower end of the spine, the blows having the effect of severely shaking up the brain substance.

Symptoms.—These vary in their severity, according to the force of the blow applied. The patient may present the appearance of being merely stunned, or he may be in a condition identical with that described in a case of shock.

Treatment.—Adopt that described for shock, but apply cold in the form of ice or wet cloths to the head. Avoid the alcoholic stimulants,

but administer hot beef-tea or hot coffee, and keep the patient absolutely quiet in a darkened room.

5. **Compression of the Brain—Causes.**—Injuries to the head, producing pressure on the brain substance, either by the depression of a piece of bone on to it, or by a blood-clot resulting from the rupture of a bloodvessel.

Symptoms.—These resemble those of apoplexy, which see.

Treatment.—If there is a wound on the head, dress it; otherwise adopt the same treatment as for apoplexy.

6. **Apoplexy** (also known popularly as "a stroke" or as "paralysis")—**Causes.**—Usually the result of the bursting or a diseased bloodvessel in the substance or on the surface of the brain, causing compression of the latter. It is common only in old people.

Symptoms.—The patient is more or less unconscious; the face is flushed; the breathing is deep, slow, and stertorous; the eyes are insensitive to light and touch, and the pupils are fixed and unequally dilated, or one or both pupils may be contracted; the pulse is full and slow; and there is paralysis affecting one side of the body, more or less.

Treatment.—The object of treatment is to get the circulation quiet and the heart's action as free from embarrassment as possible; therefore loosen all tight clothing about the neck and chest. Put the patient to bed, keeping his head raised, and apply cold to it; apply hot-water bottles and mustard poultices to his feet. Give no stimulants, nor anything by the mouth, as it may choke the patient. Send for medical assistance.

7. **Alcoholic Intoxication—Symptoms.**—A person in a state of stupor from alcohol presents the following picture:

He is unconscious, but can be partially roused; his face is flushed and bloated; his eyes are reddened and bloodshot, but are not insensitive to touch; his pupils are equal, dilated and fixed; his lips are livid; his breathing is slow; the surface of the body is cold; and he may smell of liquor.

Note.—Alcoholic stupor may be hard to distinguish from apoplexy; but the **state of the pupils**, the **sensitiveness of the eye to touch,** and the **presence or absence of paralysis,** will help to determine the condition.

Treatment.—See Poisons, Alcohol.

Caution.—If in doubt as to whether a person is suffering from apoplexy or drunkenness, treat him for the former, and be particularly careful **not to make him vomit.**

8. **Narcotic Poisoning.**—See Opium-poisoning, under Poison.

9. **Sunstroke—Causes.**—Exposure to the rays of the sun.

Symptoms.—There is at first giddiness, nausea, and weakness, followed by drowsiness and more or less unconsciousness. The eyes are bloodshot; the skin is hot and dry; the breathing is quick and noisy; the pupils are contracted at first, and then become dilated; the pulse may be slow or quick; there may be convulsions.

Treatment.—Place the patient in a cool spot in the shade; remove his clothing from his neck and upper part of his body; douche his head, neck, chest, and spine with cold water, or wrap cold sheets round him; continue these cold applications till he becomes conscious. Then remove him to bed in a darkened room. Watch him carefully. If the unconsciousness returns, renew the application of cold.

10. **Freezing—Treatment.**—Take the patient into a cold room, rub the body with ice-cold water or snow; restore warmth gradually. It is dangerous to apply heat too early. As soon as the patient is able to swallow, give him stimulants and hot drinks.

What to Do If a Patient Is Found in a State of Unconsciousness.—Before efficient help can be rendered, the first thing to do, is to find the **cause** which has produced the state of unconsciousness, and in order to do this a systematic examination of the patient and his surroundings must be made, therefore proceed as follows:

(i) Notice the position of the body and its surroundings.

(ii) Notice whether the body is lying still or there are convulsive movements, and also if the convulsive movements are general, or confined to one side of the body.

(iii) If possible obtain information from bystanders as to the cause.

(iv) Lay the patient on the back, inclining the head to one side (to prevent the tongue from falling back or vomited matter going down the windpipe); if the face is flushed slightly raised the head, if the face is pale keep the head flat, place the arms by the sides and extend the legs, and loosen all tight clothing about the neck and chest.

(v) Examine the head, to ascertain whether there is a depressed wound (which would suggest compression), or a mere bruising (which would suggest stunning).

(vi) Examine the **eyes** to see if they are sensitive to light and touch, if there is any squinting, and the state of the pupils:

(a) If the white of the eye is sensitive to touch, no brain injuries are present.

(b) If the pupils are unequally contracted, there is brain injury.

(c) If the pupils are small and equally contracted, there is opium poisoning.

(vii) Examine the **face**;

(a) If it is drawn to one side apoplexy or compression of the brain is indicated.

(b) If it is bloated and flushed the excessive use of alcohol is suggested.

(viii) Smell the **breath**; the odor of opium or alcohol may be detected.

(ix) Examine the **mouth** and **tongue**; froth in the mouth and a bite on the tongue indicates fits, particularly epileptic.

(x) Notice the **breathing**;

(a) If it is slow, it indicates great weakness, as in shock.

(b) If it is snoring (stertorous), it indicates brain trouble.

(xi) Examine the **pulse**;

(a) If it is slow, there is brain trouble.

(b) If it is rapid, there is sunstroke or fever.

(c) If it is quick and thready, there is great weakness—such as shock.

(xii) Feel the **surface of the body**;

(a) If the skin is abnormally cold, there is either freezing, intoxication, collapse, or fainting.

(b) If the skin is hot, there is sunstroke or high fever.

(xiii) Examine the **ribs, collar bones** and **limbs** for fractures.

(xiv) Examine the limbs to see if there is any **paralysis**; this is done by raising the limbs and allowing them to fall; if they do so lifelessly it suggests paralysis.

(xv) If convulsive movements are present, the patient is suffering from fits of some kind (either epileptic, hysterical or uræmic in an adult, or convulsions of infants), or they may be pretended.

(xvi) Examine the **neck** for evidence of strangulation or hanging.

Fits.

1. **Epileptic Fits.**—The distinguishing features of these fits are convulsive movements and unconsciousness. An epileptic fit is usually ushered in by the patient giving a cry or shriek, falling down, and all the muscles of his body becoming perfectly rigid. This stage of rigidity is succeeded by a stage of convulsions, in which the patient's body is thrown into a state of violent twitchings and contortions, with

foaming at the mouth; and during this stage the tongue may be bitten. After the convulsive stage has lasted a few minutes, it is followed by a period of partial unconsciousness, which may continue for a variable period, and the patient then finally falls into a deep sleep. The patient does not know that he has had an attack, but should be told that he is subject to falling and be warned against going on ladders or places from which a fall would be dangerous.

Treatment.—During the convulsive stage place the patient in a safe position, and prevent him from hurting himself; put a piece of wood or other hard substance between his teeth, to prevent him from biting his tongue; loosen all tight clothing about his neck, chest, and abdomen; and do not attempt to administer anything by the mouth, as dangerous choking may result.

After the convulsive stage has passed off, and the patient seems drowsy, encourage natural sleep. If on waking he seems exhausted, give him a little soup or beef tea, but no stimulants. The patient should be placed under treatment by a regular doctor, who will be able to stop the fits permanently if the disease is not of too long standing.

2. **Hysterical Fits.**—These occur more often in females than males, and are ushered in by crying, sobbing, or laughing, without any obvious cause; jerky movements of the limbs occur (not truly convulsive); the breathing is quickened; the eyelids are closed. In severe attacks the patient falls down, apparently unconscious, but takes care never to hurt herself.

Treatment.—The best plan of treatment is to let hysterical patients alone, and exclude all fussy friends. As the patient begins to realize that her condition is exciting no sympathy or alarm, she will soon come to herself.

3. **Children's Fits.**—These are usually caused by teething, constipation, indigestion, adherent prepuce, or some other cause of irritation, such as worms. Children's diseases, such as scarlet fever, etc., may cause fits in the beginning of the illness. Fits occur also in brain disease.

Before a fit comes on the child is usually fretful and peevish.

A fit is ushered in by the muscles twitching; the body then gets stiff for a few seconds, and then the limbs begin to jerk, and the face twitches; the pulse is rapid and weak; the breathing is hurried; the skin is wet with cold, clammy perspiration. The child becomes partly unconscious and then falls into a sound sleep, or the fit may be repeated. During the fit there is complete loss of consciousness.

Treatment.—Place the child in a bath, at a temperature of 90° F.

(as warm as can be borne, adding more hot water slowly, but with care not to cause scalding), from ten to twenty minutes, or put the feet and legs in a pail of hot water with mustard in it; place cold sponges on the head, changing them frequently, and send for medical assistance. The cause must be ascertained, if possible, and removed.

4. **Convulsions from Uræmia** (Kidney Disease).—These may come on suddenly in the course of Bright's disease. They may vary in degree from mere twitching of the body to general convulsions, with complete unconsciousness.

Treatment.—Send for medical assistance. In the meanwhile apply cold to the head and a mustard plaster across the small of the back; place the patient in warm blankets, and apply hot water bottles to his feet and around him, the object here being to encourage sweating.

INSTRUCTION TWENTY-NINE—*Burns, Frost-Bite, Etc.*

Quick Treatment *of* *Burns—Scalds—Frost-Bite*

Subject Reference

For Surgical Treatment of Burns, Scalds, Frost-bite, see Vol. 2, pages 32 and 33.

For Prescriptions Burns, Scalds, Frost-bite, see Vol. 2, pages 630-631.

BURNS AND SCALDS.

Burns are caused by the application of fire or dry heat, **scalds** by the application of hot liquids or moist heat (steam or hot air and steam). The treatment is the same for a burn or a scald.

Degrees of Burns.—Burns are divided into the following degrees:

First degree—a mere reddening of the skin; no scar results, but if often repeated the part becomes browned or reddened.

Second degree—with the formation of blisters; no scar, but a redness which fades out in time.

Third degree—the whole thickness of the skin is affected and the epidermis is destroyed. An ulcerating wound is apt to result, but in time the wound heals over and the epidermis is renewed.

Fourth degree—the whole thickness of the skin is destroyed and the underlying muscles or bone are laid bare. A smooth scar results.

Fifth degree—the flesh is charred and destroyed right down to the bone. Usually results in at least loss of a part of the extremity.

Burns which cover over one-third of the surface of the skin are usually fatal, even if only of the first or second degree. The pain is

most severe in the milder degrees. The nerve-endings are destroyed in the severer degrees and hence no pain at all may be felt, but death occurs from shock.

Burns and scalds, in addition to the actual destruction of the tissues, produce:

1. **Shock to the System,** which is in direct proportion to the superficial extent of the burn. Burns of the abdomen and chest are especially liable to produce marked shock, and in children suffering from burns and scalds shock is usually profound. Exposure to the air especially aggravates the condition of shock.

2. **Congestion of the internal organs,** coming on after the shock.

Treatment.—In the management of burns and scalds two points have to be borne in mind:

1. The treatment of the local injury.
2. The treatment of shock.

If the shock is severe, treat it first, and wait till reaction sets in before treating the local injury.

The Treatment of the Local Injury.—In attending to this, care should be taken that the **clothing is removed with the utmost care from the burnt part,** and that no blisters are broken. The clothing should be **cut off,** and if parts of it adhere, they should be gently removed by first soaking them in oil; and if this is not sufficient, the part should be immersed in a bath of warm water. If the burns are extensive, only one part of the body should be dressed at a time, the rest being kept covered up.

To dress the burns proceed as follows:

Apply over the part pieces of lint which have been dipped in either Carron oil (a mixture consisting of equal parts of linseed oil and lime water, well shaken before use) or in carbolic oil (1 part of carbolic oil in 40 parts of olive oil), or in a saturated solution of common washing soda; or spread upon pieces of lint boracic acid ointment (which has been diluted with an equal part of vaseline), and apply it; or paint (or sop) the part with a saturated solution of picric acid in water, and cover it up with cotton wool. In the open or dry method of treating burns the wound is well covered with a mildly antiseptic powder, such as boracic acid and starch or flour or talcum powder. Blisters should be carefully opened by piercing them at the edge with a needle which has been cleaned by holding it in a flame till red at the point and then cooled.

N. B.—Do not use strong antiseptics for dressing burns, and do not change the dressings too often.

Burns Caused by Acids.—Drench the parts first with water; then wash in a solution of washing soda and water, and treat as an ordinary burn.

Burns Caused by Alkalies.—Drench the parts with water; then wash in a solution of dilute vinegar and water, and then treat as an ordinary burn.

Burning Clothing.—To extinguish the flames from burning clothing, make the person lie down (or seize and put him down), and quickly cover him up with a rug, coat, shawl, blanket, or other woolen article; cotton and linen burn too readily themselves, but may be used if no woolen thing is handy, as they will smother the flames if applied quickly and closely. To run about the room or outside will only fan the flames. Drench the clothing as quickly as possible with water, because the glowing parts will continue to burn after the flames have been put out. The head should be placed low because flame tends to rise and burns about the face and hands are most disfiguring, as well as dangerous to the eyes, and are apt to be inhaled.

The inhalation of steam or the **drinking of scalding liquids** may cause edema[1] (or dropsy) of the glottis—the "voice box," which contains the passage or opening from the throat to the wind-pipe. Death by suffocation may result within a short time. The symptoms of edema of the glottis are gradual loss of voice, difficulty in breathing, gasping respirations, cyanosis[2] and a flickering pulse. An artificial opening into the trachea, or windpipe, may be necessary to save life and a surgeon should be summoned **immediately.**

FIRE.

In case of fire it is worse than useless to get excited, reckless or frightened. Be calm and deliberate. If the fire is small and you can smother it with rugs, or with a handy pail or jug of water, do so. If it has got a start and is beyond you **give the alarm.** Next **close all doors and windows.** If open, they only supply fresh air and make the fire quickly worse. If closed, the fire will burn but slowly and may go out of itself and flame and smoke are prevented from spreading through the house. In many cases the mischief may thus be confined to the original room in which the fire started. If there

1. *Edema,* or anasarca, is due to the escape of the fluid part of the blood from the veins and capillaries into the tissues. It causes swelling, which may be very rapid.

2. *Cyanosis* is a condition due to insufficient regeneration of the blood when either the respiration or the circulation is pure. It causes *blueness* of the lips, finger-tips and skin in general.

is a fire department, be ready to show them where the fire is and how to get at it. In a large number of cases, fires start in the rear of dwelling houses, usually from the kitchen flue, or from the furnace, which is frequently located under the dining room. If the inmates of the burning house have given timely alarm, and carefully attended to the foregoing, there is but little danger of a general spread of the fire.

Avoid panic. Flames at the window of a house may be due only to burning curtains, so go quietly and quickly to the door, ring or knock, and go in at once and shut the door to avoid draught. Call out, but try to avoid frightening the inmates. Smother the flames and dash water on burning woodwork. Doors must be kept shut, especially those opening into enclosed stairways.

Attempts made by the family to save household goods and trinkets often seriously handicap the firemen. Many times the firemen have been blocked on their way to the upper rooms by furniture that was being carried down stairs, or by heavy trunks dragged to the top steps and allowed to tumble down. There is loss rather than gain in pitching one's effects out of doors, where, if it is not injured by the fall, it is more than likely to be trampled upon, or damaged by water. Paintings and pictures are among the things most easily ruined by heat and smoke. If there is time, these may be removed from the walls of the threatened room. It may be wiser to depend on the salvage corps, which responds promptly and knows better than others how to save household goods, because the members of this corps have experience, strength and means with which to work. It is surprising how quickly household property can be gathered into the middle of a room and covered against injury by water or falling plaster. Often, if the precautions mentioned are faithfully observed, a fire may be extinguished by the use of chemicals with only nominal damage.

Finally, be prepared. Sit down and think and decide right now what you will do if a fire occurs. Think **where** a fire is most apt to start in your house—kitchen stovepipe, furnace pipe, curtain near a gas jet or lamp, ash receptacle, glowing match in waste paper basket, etc. Think out how you will shut doors and windows, and where and how you will give the alarm. Fire drill in schools has saved many lives. The greatest danger is **panic,** and the drill is the best preventive of this.

Lamps must be placed always in a safe position, so that there is nothing above the lamp to catch fire. Do not throw water on burning oil,

but use earth or sand, taking this from flower pots if handy, or use a rug or something thick and heavy to smother the flames. Do not fan the flames toward yourself, but hold the edge of the rug under your foot while you throw it over the fire.

To rescue a person from a room filled with smoke, take a deep breath of fresh air (after covering the mouth and nose with a wet handkerchief if one is handy, but lose no time), then crawl in, keeping your face near the floor, and drag the person out into fresh air. If necessary, use artificial respiration at once.

When a Person's Dress Gets On Fire.

A girl or woman should at once lie down, or be thrown down. *Flame mounts upward.* A good lesson to children is to set fire simultaneously to two upright figures below and throw one down after two or three seconds and compare the rate of burning. Fire is strong and deadly. The first few seconds are most precious and prompt proper

Fig. 230A. How to use a rug or blanket to extinguish flames in a person's clothing. The edge of the rug is held under the foot (right or left) and the rug lowered on the head first so as to drive the flames away from the face.

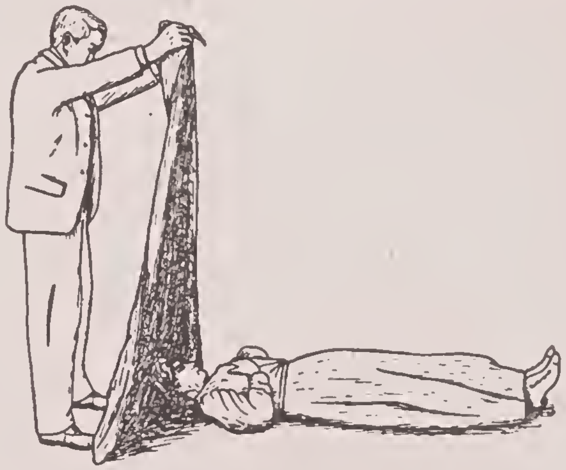


Fig. 230B. Tucking the rug close in and pressing out all the fire. The victim's face should be uncovered to avoid inhaling the smoke.

action then will often save a life and always lessen the injury. Do not hesitate to use valuable rugs or clothing if it is handiest. A woman rescuer runs great risk. If the victim will not lie down, take a blanket or rug, hold it in front of you and approach the burning person; quickly wrap the rug around them and drag them to the floor, keeping away from the flames. If the person lies down when told to, approach them

by the head, hold the edge of the rug with your foot and stooping down throw it over the person, driving the flames towards their feet; then uncover their head and kneeling down tuck the rug close about them and press all the fire out.

Women should practice doing this with pretended fire. They will then more easily "keep their heads" (and lives) in a real emergency.

Frost-bite.

Treatment.—Take the patient into a house or room with no fire in it; rub the part with snow or ice cold water till the circulation has been restored to it. This is to **thaw it slowly,** which makes the damage less. Treat the frostbite, after thawing, like a burn, dressing it with Carron oil.

Caution.—Do not take him into a warm room, or set him by a fire, or use warm applications.

Electric Shock.

This may be produced by:

(i) **Natural Electricity**, as lightning.

(ii) **Artificial Electricity,** as currents from telegraph, telephone, electric lighting and motor wires or rails.

Natural Electricity.—The effects of lightning vary; there may be only **slight shock** with dizziness, or there may be **violent convulsions, insensibility** or immediate **death**. The physical injury may be severe.

Artificial Electricity.—The danger of a current of electricity is in proportion to its strength—thus, the low tension currents of the telephone and telegraph wires would probably only produce **slight shock,** while the high tension currents (and especially the alternating ones), for lighting and motor purposes are extremely dangerous.

The current from a dynamo may be 10,000 volts, for arc lamps the current is usually 2,400 volts, and for lighting (in houses) 100 volts.

A current of 100 volts is very dangerous; from 20 to 30 volts is as much as can be comfortably borne by a strong man.

When electric wires have a current passing through them, they are termed **live wires,** and it is from these that there is danger, as they may be exposed either by accident or for repairs.

Symptoms.—A person taking hold of **naked** (i. e., those that are not covered with an insulating material) live wires, with a current of high tension passing through them, becomes **violently convulsed and unable to let go**, or there is **insensibility** with suspended animation or

even **death.** Parts of the body or clothes in contact with the wires may be scorched or burnt.

Treatment.—Here proceed as follows:

(i) Remove the sufferer from the source of danger; this must be done with the greatest care, or the person giving assistance may himself receive the shock and be rendered incapable.

"When the injured person retains his hold of the wire, it is dangerous to touch any part of him, even the parts of the body covered by clothes." A case of this kind is recorded in the Electrical Review: "While a man was cleaning an electric street lamp in Boston, he received a shock and was killed, his body being suspended from the wires; a man who endeavored to remove the body came in contact with the current and was dashed to the ground with such violence that he died shortly afterwards."

Therefore, before removing the sufferer, first protect the hands whenever possible with india rubber gloves (these are used in electrical works and may be at hand); if these cannot be procured use india rubber tobacco pouches, or wrap a macintosh coat or a thick **dry** woolen cloth coat, or other **dry** article of clothing around the patient (damp articles of clothing are good conductors of electricity, and the sufferer's own clothes may be damp from perspiration), and then standing on an india rubber mat or a pile of **dry clothes** pull the sufferer away from the source of danger. The wires may be cut by nippers with insulated handles or held in insulating mits.

Two live naked wires of which the sufferer may have hold, may be **short circuited** by dropping (not placing, as then the assistant might get the shock), an iron bar or other metallic tool across them, in this way carrying the current from one wire to the other (through the wire or bar dropped across) instead of through the body of the sufferer.

(ii) Send at once for medical assistance, but in the meanwhile place the patient in a comfortable position, loosen all tight clothing around the body, and if there is any difficulty with the breathing begin at once to perform **artificial respiration.** Treat as for shock and burns.

Removal of Foreign Bodies.

1. **From the Eye.**—Foreign bodies may be removed from the surface of the eye as follows: If under the **upper** lid, first evert the lid by placing a bodkin or match over it, and then taking hold of the eyelashes, while the patient looks down gently pull the lid down and outward and turn it over; in this way the whole of the surface of the

conjunctiva of the upper lid is exposed and may be very gently swept over with a camel's hair brush, or with a piece of soft linen dipped in warm water.

If under **lower** lid, the whole of the conjunctiva under the lower lid may be exposed by gently pulling the eyelid down with a finger, and the foreign body removed as described above.

When a foreign body gets into the eye do not rub the eye, but close it and keep it still. The tears will flow freely and will raise the lid and wash the object down to the corner of the eye and out. It does no harm to rub the other eye and to blow the nose gently, which drains the tears away more quickly.

2. **From the Ear.**—Great care should be taken in these cases not to poke any instrument into the ear, as the drum might easily be injured. The case is not one of urgency, therefore do nothing but take the patient to a doctor.

3. **From the Nose.**—The nose should either be blown forcibly, while the other nostril is held, or gently syringed out with warm water, or the patient may be made to sniff pepper and sneeze. Or a tube may be placed **in the other nostril** and while the patient's mouth is kept shut, suddenly blow through the tube; the air will pass back to the throat and then out through the nostril in which the foreign body is lodged. This is a good plan with children, but is not advisable for objects that are firmly lodged in the nose, nor should much force be used in blowing, lest the ears be damaged. Sneezing is the most generally useful and safe method.

How to Avoid Accidents.

1. Never play with **firearms**. Always handle one as if it were loaded and ready to explode any moment. Never leave them in reach of children.

2. Never use a **kerosene can** near a stove. If you wish to use kerosene to start the fire put a teaspoonful in a cup and pour it on the ashes below the kindling and be careful in lighting it.

3. Never trim nor **fill a lamp** while it is lighted. Be sure to clean, trim and fill them in the day time.

4. Keep your **matches** in tin boxes out of reach of children. Never leave one on the floor. Do not drop an extinguished one before it is cool and can be held by the burnt end between the fingers.

5. Keep all **medicines**, either internal or external, in a safe, dry box, beyond children's reach or climb. Label every bottle or package and throw away all that are not labeled. Have special corks or

rough bottles for all **poisonous things** and mark "Poison!" on the label.

6. Do not jump out **if the horse runs away.** You may not be hurt at all if you stay in and you are sure to be if you jump. If necessary, you can *throw the horse down* by dropping one rein and *suddenly pulling hard* with both hands on the other.

7. Look where you are going, especially at corners and crossings. At railway and car **crossings** always look out for more than one train or car, and **look, for you cannot hear the other one!** Do not put your head or arm out of a car window while in motion.

8. **Do not take chances.** Never get on or off a car in motion. In alighting, always face in the direction in which the car is going.

9. Do not stay still in **wet clothing,** and change it as soon as you can.

10. Avoid mosquitoes and malarial night air.

11. Do not walk along a railway track.

12. Do not go bathing beyond your depth, even if you do swim well.

13. Do not leave young children alone while they are awake.

14. Do not go into a deep well before you lower a candle into it. If the candle goes out, throw in half a pail of freshly slacked lime to absorb the carbonic acid gas in the well.

15. Don't go near trees, nor use a telephone, in thunder storms.

16. Don't handle gunpowder after dark.

17. Don't set a lamp near a curtain; the wind may blow the curtain over to the flame.

18. Don't use **gasoline** or benzine in a room where there is any kind of flame or artificial light.

19. Don't eat food that is not certainly sound and safe.

20. Don't drink water that is not known to be pure in its source or by boiling.

21. Don't drink or eat anything in the dark. Especially, do not take medicine in the dark.

First Things to Do in Accidental Injuries.

1. Do not get excited. Keep cool; act and speak quickly.

2. Send for the doctor if the case is serious. The message should be written, unless sent by one who can tell it correctly; state briefly what has happened.

3. Keep curious bystanders out or at a distance. Take the pa-

tient to a quiet, clean, airy, light place. An engine room is too hot, noisy and dirty.

4. Make the patient comfortable lying down on his back, with his legs straight. Raise the head a little if it is injured. Open the collar and loosen the belt or waistband. Lower the patient's head if he is faint. If the patient vomits, or feels like it, turn him on his side to avoid having what is vomited go into the windpipe. Watch him carefully if unconscious.

5. Examine wounds (cutting or ripping off the clothing if necessary), stop the bleeding, clean and dress the wound as quickly as can be done properly. If a doctor is coming do not interfere with wounds any more than to stop the bleeding (unless it will be hours before the doctor arrives) and relieve faintness or unconsciousness. In this case proceed as directed under **Wounds, Fractures, Shock, Hemorrhages**, etc.

6. If a needle has entered and remained in the flesh take care not to break it off. Examine it carefully on removal and, if broken, keep it to show to the doctor, who must be seen at once.

A MOTHER'S LOVE

PART FIVE—*Babyhood and Childhood*

CHILD WELFARE

Babyhood and Childhood

INSTRUCTIONS TO MOTHERS

HOW TO BRING UP CHILDREN IN A RATIONAL AND SCIENTIFIC MANNER

A Competent Mother
The Primary Need of An Infant

When the New Baby Arrives.
Physical Condition of the Child.
How to Dress Baby.
The Nursing Mother and the Nursing Child.

Weaning and Diet.
When the Mother Cannot Nurse Her Child.
Wet Nurse and Bottle Feeding.
What To Do If the Baby Is Not Gaining.

Baby's Exercise and Sleep.
The Size and Weight of the Baby.
Baby Should Have Its Own Little Bed.
The Training of Children and Infants.
Baby's Troubles and Ailments.

Teething and Other Difficulties.
Accidents That May Happen to Children.
Diseases of Children.
Medicines for Infants and Children.

INTRODUCTORY.

It is a fact, curious as true, that a human being may often be put to shame by the brute creation.

The mere animal seems instinctively to know how to care for and provide for its young, from the first moment of its arrival till the time that it is enabled to look after itself.

The intelligent and highly cultivated female of the human race seems, however, to be deficient in instinct on this matter. What lamentable ignorance is often displayed by a young and inexperienced mother in the bringing up of her offspring! There may be plenty of love and affection, but no knowledge.

A young mother is usually influenced a great deal by friends or nurse, and, where the nurse is intelligent and properly trained, this is a good thing. Unfortunately, many so-called nurses have no right to the name at all; they have inherited, or invented, certain ideas on the bringing up of a baby, to which they cling with all the tenacity of obstinate ignorance.

Many mothers and nurses, however, know that there must be a right way of bringing up a child, and are anxious to know what that right way is.

No two babies are exactly alike, and every child has its own peculiarities; but if mothers only knew some of the general principles which underlie the successful rearing of healthy children, they would be able to deal with each individual case properly. Thus, instead of being at the mercy of everybody's opinion and advice, the mother will be enabled to go on in her own way, knowing that it is the right way, and, at the same time, will have a good, sound reason for all that she does for baby, be it with regard to clothing, food, ventilation, or anything else.

It may seem a Utopian idea, but it would certainly raise the standard of health in the next generation, if every girl were obliged, before leaving school, to pass an examination on the very important subejct of "How to Bring Up a Baby."

BEFORE THE BABY COMES
HOW A BABY IS BORN

Conception Takes Place, Then the Fertilized Egg or Seed Grows Into a Baby.

What Is Conception?—It is necessary to understand how conception occurs, for it helps to understand the anatomy and arrangement of the womb and other sexual organs of a woman.

Except in the very lowest forms of life, a new individual is always created by the union of a male with a female element. Both these elements are so small that they can only be seen by means of a microscope. Again, it is a law of nature that the male element moves to and finds the female element. For example, in the vegetable world the pollen or male element is carried to the ovum or female element either on the bodies of insects or by the wind. The pollen, for instance, of pine trees, which forms the fine yellow dust you see in the spring in pine woods, has two little bladders so that it can be blown by the wind towards other pine trees and reach the ovum or female element on the small flowers of these other pine trees. When it has reached it, the male element joins with the ovum, and the ovum is said to be fertilized and becomes a seed, which, properly nourished and under suitable conditions, will grow into a new pine tree.

In human beings the same sort of thing happens. The male elements, or spermatozoa, as the result of cohabitation, pass from the testis, down the tube of the male organ into the vagina of the female. They are able to move by a long tail which each possesses, which is used for movement much as a tadpole uses its tail. A spermatozoon in this way meets an ovum or female element, the two join and become a fertilized egg or seed, which grows into a baby, provided the wall of the womb on which the seed is planted and other general conditions are favorable.

THE OVARIES, FALLOPIAN TUBES, UTERUS AND VAGINA.

To understand conception and pregnancy better, one must understand the female organs which are made for conception and child-bearing. These organs all lie in a woman's pelvis, and are protected by the strong pelvic bones.

The Ovary.—The first organs with which we are concerned are the ovaries, for there are two, one on the left of the womb and the other on the right. The ovary is an oval body, whitish in color and about the size of an almond nut. As the testicles or male organs bear the male elements or spermatozoa, so the ovaries bear

the female elements or ova (ovum—Latin for egg). In diagram A at 1 we see the ova lying in the ovary. At 2 we see one ovum has burst from the ovary and is falling into a trumpet-shaped cup. This is exactly what happens in a woman. It usually happens just at the end of a menstrual period, which is the time when a

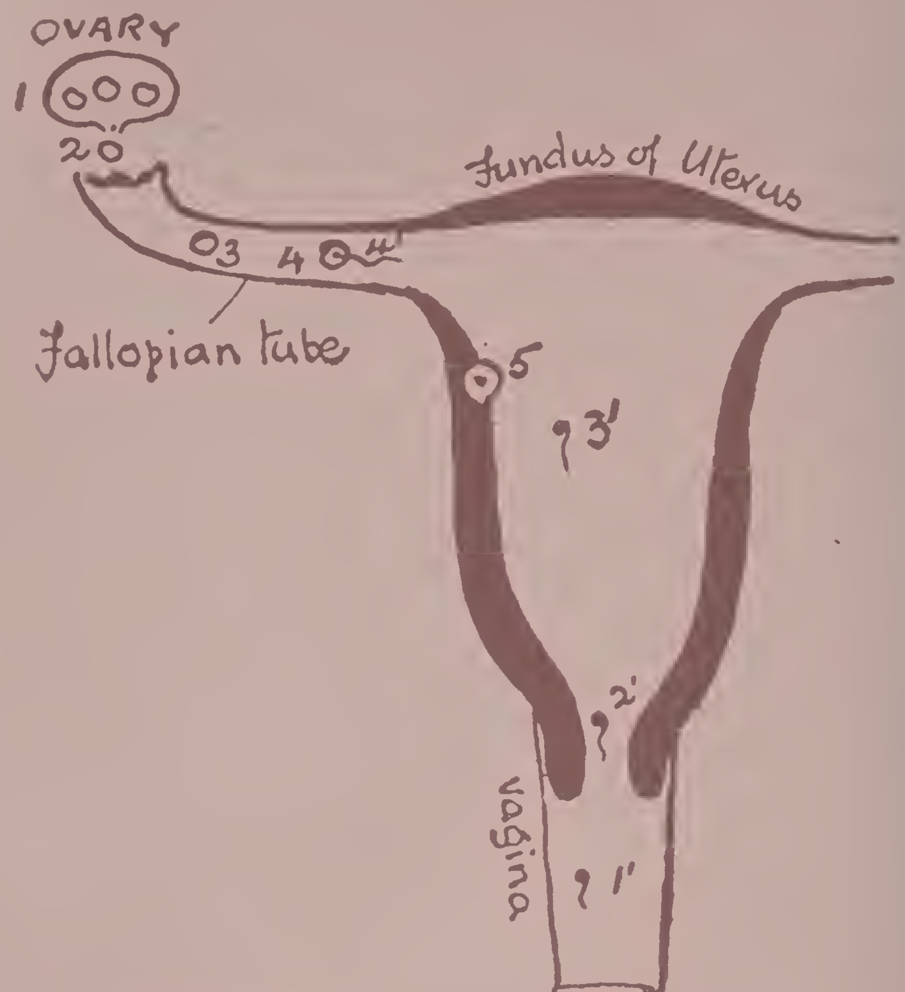


Diagram A—Showing process of fertilization and conception.

woman is unwell. An egg or ovum, when ripe, bursts through the thin outer membrane that covers the ovary and falls into the trumpet-like cup, which is the mouth of a tube leading to the uterus or womb.

The Fallopian Tube.—This tube is called the Fallopian tube—called Fallopian because it was first described by an Italian anatomist named Falloppius. There are two tubes, one on each side. They are four inches long and about as thick as a penholder. The next thing that the egg or ovum has to do is to reach the womb or uterus. It is not like the male element, which can move of itself. The ovum has no power of movement. So in order that it can reach the uterus, the Fallopian tube is lined with microscopic hairs which are constantly waving in the direction of the uterus. Under the microscope they look like reeds along a river bank bending to the wind. By their means the ovum is wafted into the uterus. At 3 in the diagram you see it in the Tube.

The Uterus (uterus—Latin for the womb).—The uterus or womb, is a pear-shaped, muscular organ in which the baby lives and grows until birth. The virgin uterus is three inches long and two inches broad and one inch thick. There

are several terms connected with the uterus which you must know for they are constantly mentioned.

The Body.—Diagram A shows the body of the uterus. It is the most muscular part of the uterus. Its upper part is known as the fundus. The body forms the upper two-thirds of the uterus.

The Cervix (Cervix—Latin for neck).—The lower third of the uterus is known as the cervix or neck. The cervix projects into the vagina.

The Cervical Canal.—The cervical canal passes from the cavity of the uterus to the vagina. Its opening into the vagina is known as the external os (os—Latin for mouth), its opening into the uterus the internal os. These internal and external mouths of the canal are very definite and must be remembered. The internal os is surrounded by circular bands of muscle which keep it closed. The muscle is called a sphincter (sphingein—Greek to bind tight), and acts in the same way as the sphincter ani which keeps the back passage closed. The external os is closed by circular bands of muscle and fibrous tissue. Fibrous tissue consists of woven fibres which cannot contract like muscles. (Tissue—French for woven, hence fibres—woven fibres.) The two mouths and the canal are closed during pregnancy. They do not expand and widen, as does the body of the uterus, with the growth of the ovum, nor do they open until labor or childbirth sets in. The spermatozoon is so tiny that it easily passes through the closed canal, but the fertilized ovum gets big so rapidly that it cannot pass without the canal opening to allow it to do so.

Ligaments.—The uterus is supported by ligaments, two of which pass to either top corner of the uterus.

Vagina (vagina—Latin a sheath).—The vagina is the front passage. Into its roof the cervix and external os project. It is three inches long and opens between the thighs at the vulva.

The Fornices.—The cervix projects into the vagina. The vaginal vault that surrounds the cervix is divided into four fornices (fornix—Latin an arch), an anterior, a posterior and two lateral fornices.

Practical Application of These Anatomical Points.—Returning to Diagram A, you can now trace the whole history of conception.

First—the ovum breaks from the ovary. Second—it falls into the trumpet-like mouth of the Fallopian tube. Third—it is wafted along the tube. The spermatozoon passes into the vagina 1, then through the cervical canal 2, into the womb 3. The ovum and spermatozoon meet at 4 4^1 and the ovum becomes fertilized and the woman conceives. This meeting sometimes occurs not in the cavity of the uterus, but in the tube.

GROWTH OF THE OVUM OR EGG.

The ovum or egg is now fertilized; it is capable of growing under favorable conditions from the size of a pin's point to form the full-term baby and the afterbirth.

The Length of Pregnancy.—From conception to child-birth is on average 280 days or forty weeks or nine calendar months.

Nourishment and Excretion of the Ovum.—We next have to consider the way the ovum receives food during its growth, and the way in which it gets rid of the waste products of its life.

The Decidua.—The uterus is lined with a membrane called a mucous membrane, which is like the membrane that lines the mouth, nose and other cavities. This membrane becomes thicker and more spongy when the woman is pregnant. It is

then called the decidua. The ovum, when fertilized, becomes buried in the decidua as is shown at 5 in Diagram A. It is actually buried in the decidua and covered over by it, as a seed is buried in the soil. The decidua are so called from the Latin deciduus, meaning falling, not lasting through the year.

The Chorion (Greek chorein, to contain).—The next question to answer is how is the ovum to get food from the decidua and get rid of waste products? This it does by means of the chorion.

The fertilized egg grows rapidly and divides into many different cells. Two membranes are formed which surround the fœtus (fœtus—Latin fruit) and enclose the waters. The outer one is called the chorion, the inner the amnion.

The chorion then being the outer layer lies next to the spongy decidua. From it grow little soft branching filaments, the chorionic villi (villus—Latin for a shaggy

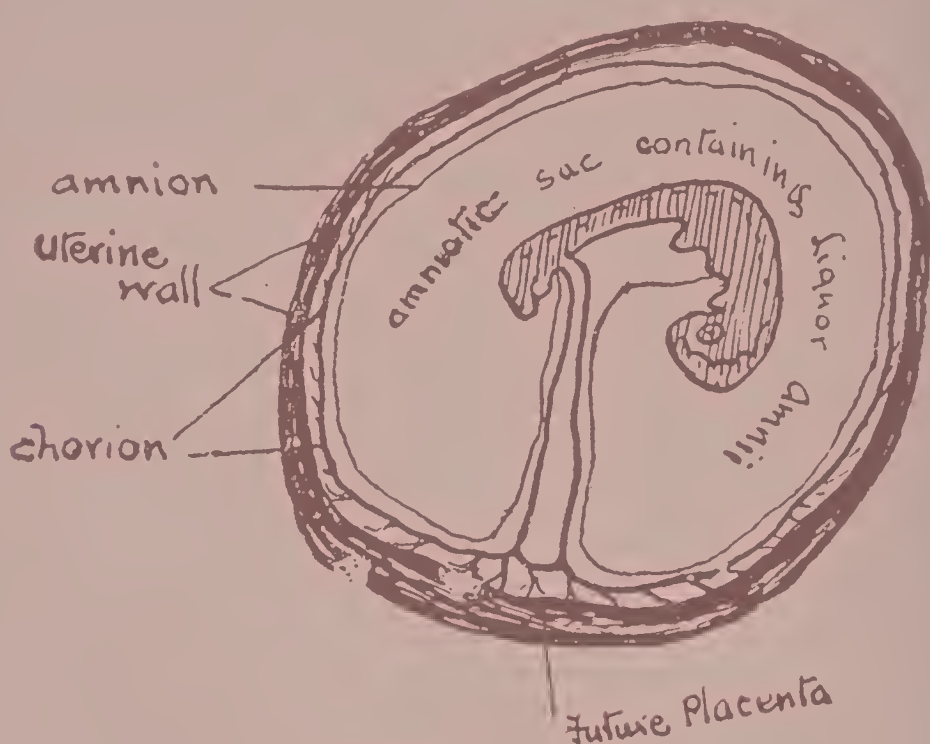


Diagram B—The early ovum.

hair), which burrow into the decidua like little roots. In each villus are blood-vessels, and the blood-vessels of the villus come into close contact with the blood that makes the decidua spongy.

We all know what water culture of plants is. We take a young plant and let its rootlets dip into a bottle containing certain dissolved substances necessary to the plant's life. The rootlets take these substances from the water and so the plant is fed, flourishes and grows.

Much the same thing happens to the ovum or egg. The chorionic villi dip and burrow into the spongy decidua and take from the mother's blood, that soaks and circulates through the decidua, the dissolved substances needed for the life of the embryo. They also give up to the decidual blood the waste substances of the fœtus.

For the first three lunar-months of pregnancy the greater part of the ovum is covered with these chorionic villi.

The Placenta (Plakoros—Greek, a flat cake).—After the third month, most of

the chorionic villi wither and disappear. Over a limited area, however, they continue to grow vigorously and form the placenta.

The placenta then is an organ composed of first, chorionic villi: second, maternal decidua.

The spongy decidua becomes honeycombed with large spaces and channels full of blood, the so-called venous sinuses (sinus—Latin, a bay, a gulf). Into these channels the wavy tufts of the chorionic villi with their blood-vessels dip, very much as the rootlets of the plant dip into the water in the water culture of plants already mentioned.

In this way through the placenta the fœtus, as the child in the womb is called after the third lunar-month, gets oxygen and nourishment from the mother's blood and gives up its waste products. The heart of the fœtus pumps the fœtal blood along the two arteries of the umbilical cord to the placenta. This blood

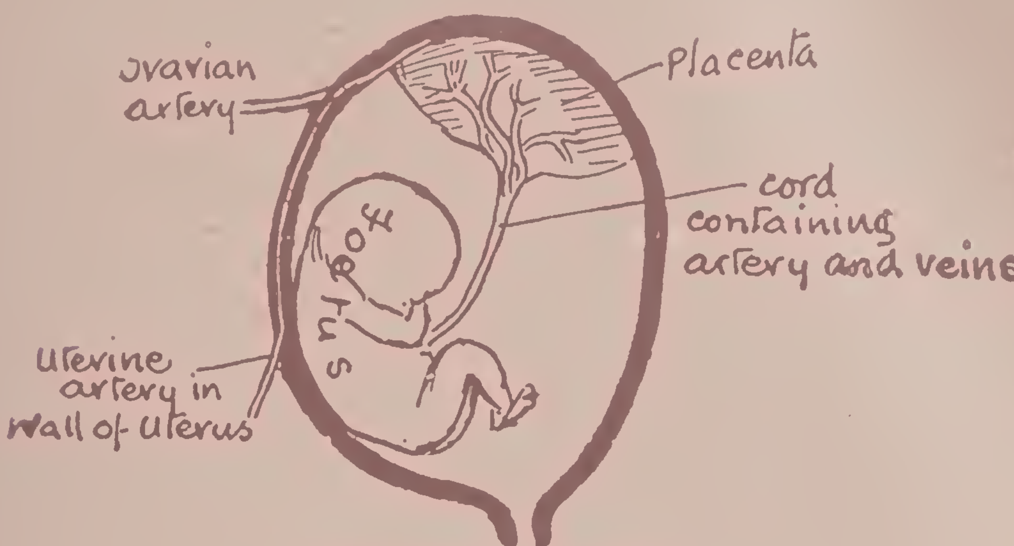


Diagram C—The foetus and placenta.

returns from the placenta to the fœtal circulation by the umbilical veins which run in the umbilical cord.

The description of the placenta will be left until we consider the examination of the afterbirth in the conduction of normal labor.

Amnion (Amnion—Greek, a bowl in which the blood of sacrificial victims was caught).—We have said that two membranes are formed which surround the fœtus: the outer the chorion, and the inner the amnion. We have seen that the chorion is the membrane that feeds the embryo. (Embruon—Greek, the fruit of the womb in the first three months.) What is the object of the amnion? The growing embryo is very soft and delicate and could be readily injured were it squeezed by the uterus in which it lies. Now as a matter of fact the uterus does get smaller or contract and then relax again about once every twenty minutes during pregnancy. To prevent the fœtus being injured, it is surrounded by water, and this water is known as the **liquor amnii.** The embryo or fœtus floats in the liquor amnii and no better means of guarding the delicate life against injury could be imagined. The liquor amnii itself is enclosed by the amnion (see Diagram B). The amnion lines the inner surface of the chorion. The two together are known as the **membranes,** and with the liquor amnii they are known as the **bag of waters.**

We have now seen how conception takes place, how the female sexual organs are adapted for this; how the ovum grows, how it gets nourishment, how it gets rid of its waste products, and how it is protected from injury by the liquor amnii.

A Normal Birth

The majority of women pass through the period of pregnancy without trouble. In normal labor both child and the afterbirth are delivered without complications within twenty-four hours of the commencement of labor. In about nine cases out of ten the babies are born in this straightforward manner.

The Process of Labor

What Is Labor?—We have considered the reproductive organs and their adaptation to the process of **Conception** and **Pregnancy.** We have now to consider them in their function of expelling the full-term ovum from the mother to the outside world. This process is known as **Labor.**

The full-term ovum consists of: First, the child or fœtus; second, the liquor amnii in which the child floats; third, the membranes that enclose the liquor amnii; and fourth, the placenta. Labor or childbirth may be defined as the process by which the expulsive forces expel the ovum through the parturient or childbirth canal.

The process of labor is a continuous one, but for the purposes of description it is divided into three stages.

In the First Stage the cervical canal, which is closed throughout pregnancy, is opened to allow the fœtus or child to pass.

The membranes over the fully opened internal os, which would obstruct the passage of the fœtus, should then break. The way is now clear for the passage of the fœtus.

The Second Stage of Labor is the passage and birth of the child.

The Third Stage of Labor is the passage and birth of the afterbirth. The afterbirth is usually born about half an hour after the birth of the child. Labor or childbirth is then complete.

Many have wondered how such a big thing as a baby could be born without serious damage to the mother.

The Expulsive Forces of Childbirth

The Expulsive Forces.—The chief force that opens the cervical canal and pushes the child out is the force of the uterus. The uterus is provided with thick muscular walls, so that it can do this, and the force of its intermittent contractions are very powerful. They are not under the voluntary control of the mother. During the later stages of childbirth, when the cervical canal is so widely open that the fœtus can pass through, the abdominal muscles also help in pushing the child out. The woman holds her breath and strains and forces the child down in the same way as she empties her bladder or rectum by straining.

Although the uterus or womb is the organ that forces the fœtus out, a small part of the uterus lies below the widest part of the child, as you see in Diagram D. It is clear that this part must expand to allow the child to pass. Nature has arranged for this by making the walls of this lower part of the womb thinner and able to be stretched. This thinner walled portion is known as the lower uterine segment.

The Cervical Canal.—We have already described the cervical canal and its two mouths. In order that the foetus may pass, the canal has to be widely opened. This is brought about by the uterus or womb in two ways. First, the thick muscle of the body of the uterus pulls the cervical canal up and opens it; second, the bag of waters is pushed into the canal each time it is opened, just as some one when resisted will push their foot through a slightly opened door to keep it open for

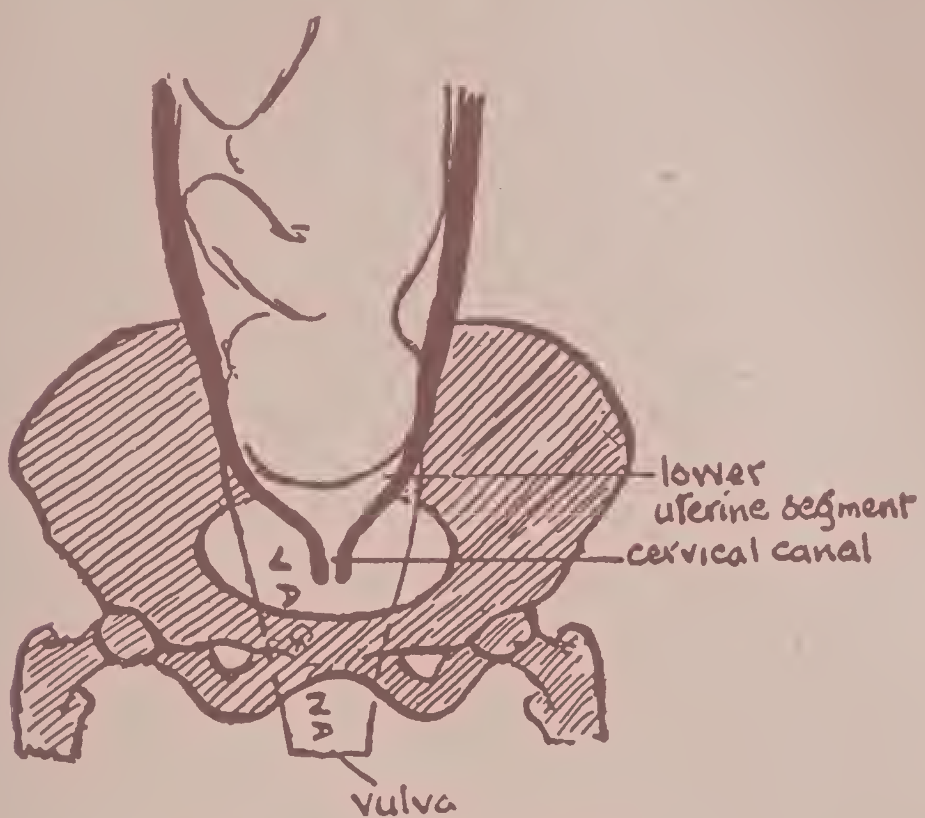


Diagram D—The parturient or childbirth canal.

another push. The bag of waters bursts when the canal is fully or nearly fully dilated and the head is pushed down to keep the canal open.

This opening of the canal is painful. Hence the intermittent contractions of the uterus, painless during pregnancy, now cause pain and are popularly known as the **pains.**

The Vagina and Vulva.—Having passed the cervical canal, the fœtal head now enters the vagina and is finally pushed out of the vulva, followed by the rest of the fœtus.

The Pelvic Bones and Pelvic Canal

The Pelvic Bones.—If you look at a bony pelvis, you will see that it consists above of bony wings, which shelve down to a more or less circular canal, as if the wings, so to speak, were intended to direct the fœtal head towards the canal. This, although by no means the only reason of the shape of the pelvis, is the reason which interests midwives. The pelvis consists of four bones. The sacrum with the coccyx forming its tip, and the two ossa innominata, one on the left and one on the right.

The Pelvic Canal.—The fœtal head is the largest part of the fœtus. How will the child's head pass through the bony pelvic canal? The head is pushed through it, much as a finger is pushed into a new glove, that is with some difficulty on the first

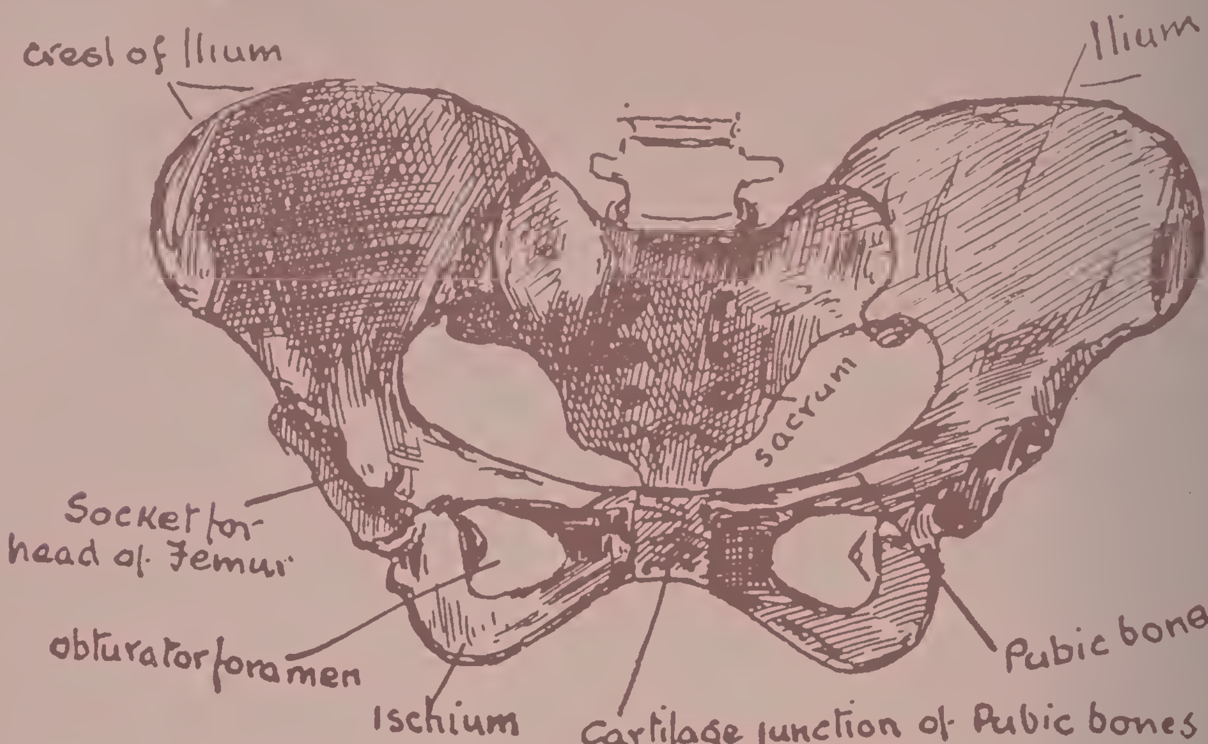


Diagram E—The normal bony pelvis.

occasion, but after this with greater and greater ease.

Once the fœtal head has entered the pelvic canal it so rarely meets with obstruction owing to the dimensions of the cavity and outlet being larger compared to the inlet, that for practical purposes one must remember that the ease or difficulty with which a child is born depends mainly on the ease or difficulty with which the fœtal head passes the inlet or brim of the pelvis. The question is one of entrance.

The dimensions of the normal pelvic inlet are 5 inches obliquely, 4½ inches transversely (for the transverse diameter is narrowed by bulky muscles), and 4 inches antero-posteriorly.

Explanation of Ordinary Terms Used By Physicians In Pregnancy and Childbirth

---

Afterbirth.—The mass of tissue expelled from the uterus after the birth.

Afterpains.—The pains which accompany the involution of the uterus.

Amnion.—The inner of the two fœtal membranes. It secretes fluid, the liquor amnii, in which the fœtus or child floats and by which it is protected from injury.

Bag of Waters.—The liquor amnii surrounded by the amnion and chorion, which are in close contact, and known as the membranes. They and the liquor amnii they enclose are known as the bag of waters.

Birth Canal.—The passage through which the child enters the world. It consists of the uterus and vagina, and is surrounded by the pelvic bones.

Body of the Uterus or Womb.—The upper two-thirds of the uterus, which expands and grows to allow of the growth of the fertilized ovum or egg.

Chorion.—The outer membrance of the two foetal membranes.

Chorionic Villi are the soft branching filaments which grow from the chorion and burrow into the decidua.

Conception.—The union of male seed and female egg; also called fertilization.

Confinement.—Childbirth; labor.

Decidua.—The mucous membrane which lines the cavity of the pregnant uterus or womb. It is thick and spongy up to the end of the third lunar-month of pregnancy.

Delivery.—The birth of the child.

Embryo.—The offspring during the first three lunar-months of pregnancy and before it assumes the form and structure of the parent is called the Embryo.

External Os.—The mouth of the cervical canal that opens into the vagina. It is kept closed during pregnancy mainly by fibrous tissue.

Fallopian Tubes.—The tubes into the trumpet mouths of which the ova or egg drops and along which they pass to the womb.

Fertilized Ovum.—The egg which, owing to union with a spermatozoon, is capable of growth. It grows from the tiny egg to the full-term baby; the placenta and membranes, for all these, except the maternal sinuses of the placenta, are developed from the ovum and therefore collectively are still called the ovum.

Foetus.—The child within the womb is known as the fœtus. It is usually called the embryo for the first three lunar-months of pregnancy.

Germinal Cells.—The original unit cells from which the new structure takes its start. The germinal cell contributed by a mother is called an ovum; that given by the father is called a spermatozoon.

Gestation.—Pregnancy.

Internal Os.—The mouth of the cervical canal that opens into the uterine cavity. It is kept closed during pregnancy by a circular band of muscle known as a sphincter.

Involution.—The process by which the uterus returns to its original size, shape, and position after childbirth.

Laceration.—A ragged wound. Tearing of the perineum at childbirth.

Lactation.—The secretion of mother's milk.

Menstruation.—The monthly flow in females.

Miscarriage.—The termination of pregnancy prior to the seventh month.

Navel.—The point in the abdomen where the umbilical cord was attached.

Neck of the Uterus.—The lower one-third of the womb, which does not grow or expand. Its canal, the cervical canal, keeps closed until childbirth.

Nucleus.—The point in any cell that is its center of life.

Obstetrics.—That branch of medical science which deals with the care and treatment of women during pregnancy and childbirth.

Ovary.—The organ which contains the egg cells or ova.

Oviducts.—The tubes which lead from the ovaries to the uterus.

Ovum.—An egg; the germinal cell contributed by the mother.

Pelvis.—The bony cavity formed chiefly by the hip bones.

Placenta.—After-birth. A spongy mass containing a large quantity of blood; it serves for the nutrition of the child in the womb, and is discharged after the birth of the child. The Placenta is formed at the end of the third lunar-month. One of its surfaces is attached to the wall of the uterus; the umbilical cord is attached at about the middle point of the other surface.

Pregnancy.—Being with child; gestation; being "in the family way."

Prenatal.—Pertaining to the period of pregnancy; before childbirth.

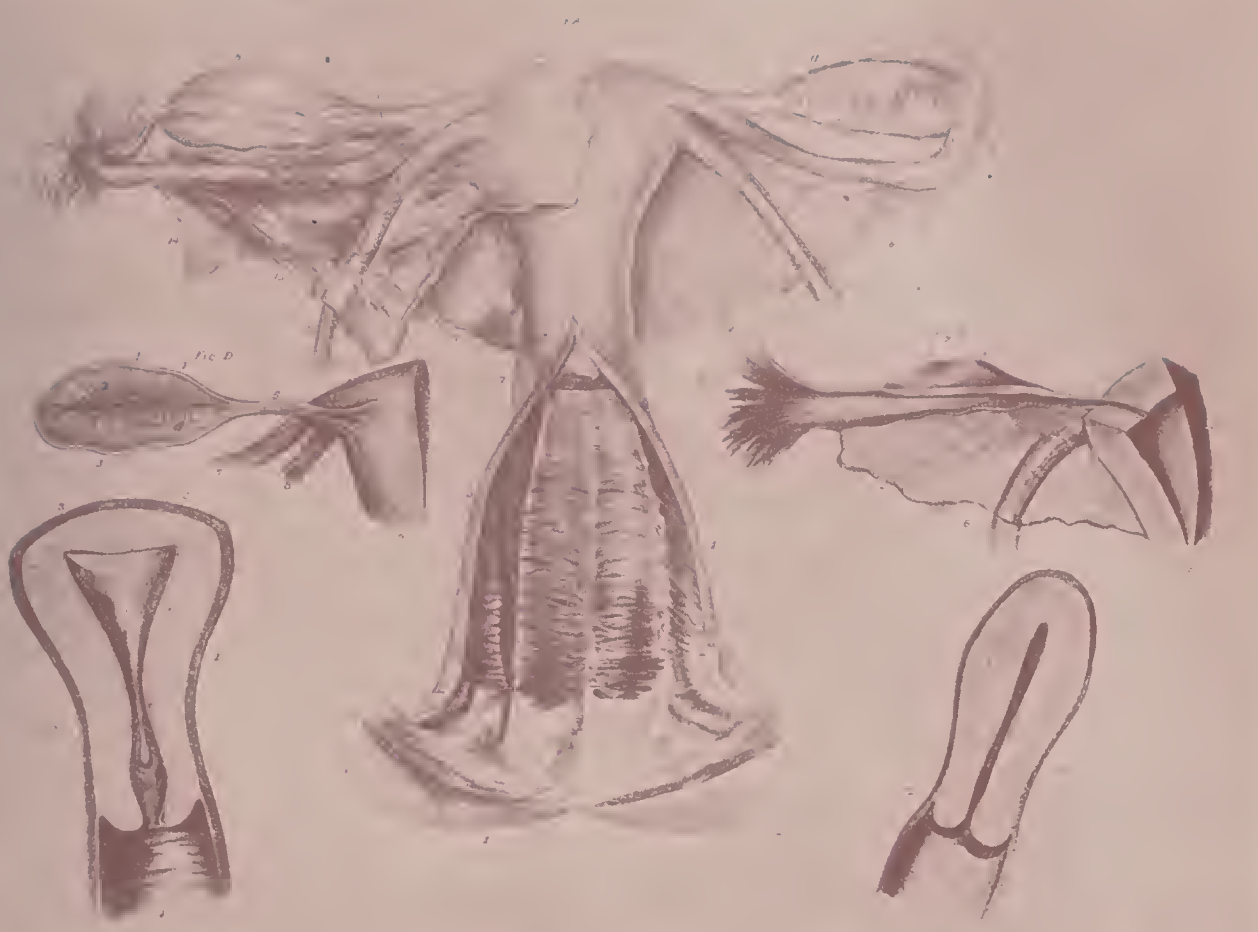
Spermatozoon.—The male element or seed.

Umbilical Cord.—The tube which carries the blood between the placenta and the navel of the child in the uterus.

Uterus.—The womb; a hollow muscular organ designed to receive, protect, nourish, and finally expel the product of conception.

Vagina.—The canal through which the child passes from the uterus into the outside world.

Vulva.—The external organ of generation of the female.



GENERATIVE ORGANS OF A WOMAN

Showing different sections, both external and internal.

Figure A—Showing the Vagina, Uterus or Womb and its various appendages. (Vagina opened to show interior; also mouth of womb.)

Figure B—Represents back part or rear half of divided uterus.

Figure C—Exhibits posterior section of the uterus or womb.

Figure D—Upright section of the ovary.

Figure E—Interior view of cavity of the left Fallopian tube (opened its entire length).

INTERIOR VIEW OF ORGANS

To understand conception and pregnancy it is necessary to understand the female organs which are made for conception and child-bearing.

This illustration is drawn to show the Bladder, Vagina and Uterus divided. The Rectum is divided in relation to its natural position when the body is erect.

FIRST PREGNANCY, FOURTH MONTH

In the fourth month the placenta or after-birth is developed. (Breech presentation is not unusual.)

PREGNANCY IN THE SIXTH MONTH

Breech presentation. At this time the uterus or womb gradually begins to assume an oval shape and determines the position of the foetus or child in the womb.

INTERIOR VIEW FULL TERM PREGNANCY

The abdomen is divided and turned back in the illustration to show the form and size, also situation of the uterus or womb when fully developed by full term pregnancy. The illustration is drawn to show the front half of the womb removed, thereby exhibiting one of the various positions of the foetus or baby at time of delivery.

ILLUSTRATING TIME OF DELIVERY

Showing one of the various positions of the head of the foetus at time of delivery in natural labor. The head has descended into the pelvic cavity.

When the New Baby Arrives

Subject Reference

For the Expectant Mother and Child-birth, see Vol. 2, pages 247 to 265.

Help Your Child to Grow Big and Strong.

Strong Bodies—Rosy Cheeks—Active Brains—Bright Eyes

The Newborn Infant—Washing—Bathing—Dressing—Hard Water—Care of the Skin —The Hair—Baby's Basket—Warmth and Quiet.

A baby, if healthy, is plump and, after washing, has a bloom like that on a ripe peach. If immature, it is extra small, has very scant hair, the nails are imperfectly formed and very short, the skin is much wrinkled and the child will easily get chilled. If yellow and wrinkled it is probably diseased.

First Washing and Dressing.

The Washing of a young infant requires great care and gentleness. The skin is very delicate, and hard rubbing, or imperfect drying, will chafe it. The gentlest handling of a naked, newborn infant gives it discomfort, and rough, awkward handling even actual pain, so that all unnecessary movements should be avoided. And as baby becomes very easily chilled, all draughts must be guarded against, and lengthy baths avoided.

Washing should be done before a fire, with a screen around nurse's chair, and the door and windows carefully shut. Before the first bath the child should be gently smeared all over with some sweet oil, which will help to remove the greasy material **(vernix caseosa)** with which the skin is coated. The nurse should wear a large flannel apron; an india rubber one beneath may guard her dress. Everything likely to be required should be placed in baby's basket within reach. The bath should be small, and be about half full of water at a temperature of 100°. It is important that the temperature be always regulated by a thermometer, failing which, the nurse's **elbow** should be the test.

See that the Birth of Your Baby is Registered

It may sometime be of the utmost importance to your child that there be in existence an accurate, legal record of its birth and parentage. It would be well to ask the doctor to make sure that your baby's birth is properly registered, or go to the register's office yourself and see that the record is made. It is suggested that a memorandum be made as shown below of certain facts recorded in the birth certificate.

Baby's name...

Father's name...

Mother's maiden name...

Sex of baby...

If twin or triplet, give number in order of birth.................................

Date of baby's birth...
(Month.) (Day.) (Year.)

Birthplace:

City, town or village...

County...

State...

Attending physician:

Name...

Address...

Baby's registered number...

Photo by Chicago Studio

A FINE SPECIMEN OF BABYHOOD

One hundred per cent prize winner six months old.

The child should be placed on its back, across nurse's knee, and be covered with a warm piece of flannel, which is not to be removed until the eyes and face have been carefully washed. The eyes must be thoroughly washed first with a piece of clean linen and a lukewarm salt or brine in a solution—an even teaspoonful to a pint of water. The lids must be opened and examined to see that there is no secretion pent up behind them. The mouth should also be very gently cleansed morning and evening with a piece of soft linen wrapped around the finger.

The whole body is then rapidly washed with a piece of flannel and plenty of soap. The child is then placed in the water, its back resting on the nurse's arm and hand. The water should cover the child entirely, with the exception of its head, and, if it enjoys it, two or three minutes may be spent in the bath. The head should of course be sponged by the disengaged hand. The child must then be lifted out on to nurse's lap, laid upon its back on one warm towel and covered by a second. These should be very soft; two of baby's diapers will answer admirably.

The Drying consists more in careful "dabbing" than in rubbing. After the front of the child has been dried, a little dusting powder should be rubbed on gently by the hand, especially in the folds of the groins, elbows, knees, etc.; the wet under-towel being now removed, the child should next be turned gently over on its stomach, and the same process repeated.

Dressing.—As soon as the drying is finished the clothes must be put on, commencing while the child is still on its stomach, by placing on its back, first the vest, then the binder, the diaper, pilch, and flannel petticoat. The child is then turned over and the cord dressed, by dusting it with some oxide of zinc or boracic powder, and passing it through a slit made in a small piece of antiseptic gauze (or a piece of cotton scorched with a hot iron or by laying it on top of a hot stove, by which it is sterilized), which is then folded up and the sides doubled over to form a little pad. The binder is now brought around, over the pad, and stitched together; it is not necessary to bind the child round and round, like a mummy. The diaper is then applied by bringing up its point between the child's legs, and pinning it together. It is well, however, before fastening up the diaper to grease the child in these regions, to prevent scalding by the wet or soiled diaper. The point of the pilch is not brought up between the legs, and only its sides are pinned together. The flannel petticoat, which generally overlaps, is then tacked together, over the child's chest,

the lower end being doubled back about three inches below the feet and secured by safety pins. The little frock is then pulled gently up over the feet, the arms put in the sleeves and the child turned over for the last time to have it fastened behind, and the head flannel applied.

Should this process have been carefully gone through, the child should be warm and comfortable, and quite ready to go into its warmed cradle for a long nap. A small india rubber hot water bottle is almost a necessity in any but the hottest weather, and should be placed in the cot, at the side of the child, between the folds of the upper blankets. Care must be taken, however, not to put very hot water in it, lest the baby be burned.

General Washing and Dressing.

For the first week the child should only be bathed once a day, and that in the morning, as it is well until the cord separates to keep it and its dressing as dry as possible. The clothes should, however, be changed, and the lower parts sponged in the evening. After a week, a bath may be given with advantage night and morning, and the temperature of the morning one may be gradually lowered until in the summer, at six months old, it may be 80°. A child should love the water, and be allowed to play by splashing about and having water sponged over its head and face.

When about a year old, if there be a large bath in the house, the child may be put into it, and after the first day or two, will probably enjoy it thoroughly. It is well, just before taking a child of this age, or rather older, out of the water, and while standing in it, to give a rapid sponge down with quite cold water: it strengthens him and makes him less susceptible to cold, but, until he is four or five years old it is not, as a rule, a good plan to give a really cold bath. If after babyhood a bath once a day is all that can be managed, it should be a warm cleansing one at night, temperature 100°, ending with a cold sponge down, and a good rubbing with a fairly rough towel. In the morning the child should be rubbed down with a wet sponge or towel. Habits of bodily cleanliness are easily learnt, and if all young America were brought up in them from the cradle, this country would soon be considerably cleaner and healthier.

Hard Water.—If the water used for cleansing purposes is very hard it is difficult to prevent a child's skin becoming rough. In towns where rain water is often unobtainable much of the hardness can be

removed by prolonged boiling, or by the use of borax, but even then, without great care in attending to all the creases, so numerous in a fat baby, chafing will occur. Sometimes it is well to employ vaseline, instead of the powder, or powder on the vaseline, for a day or two; if, however, in spite of all care, a child gets very sore and chafed, there is probably some internal derangement, and a doctor should be consulted. The diaper should be changed as often as wet or soiled.

The clear soft skin is one of the greatest attractions of childhood, and, if roughened by cold winds or hard water, a little cold cream or vaseline should be applied.

The Hair.—It is well not to wash the hair more than twice a week after baby is six months old, and then to use soft water and a little super-fatted soap.

If the skin of the head gets dry and scurfy, a little vaseline applied at night and washed off in the morning will generally cure it. After birth the hair tends to get of a lighter hue until about two years of age, after which it gradually becomes somewhat darker again. The color of an infant's hair at birth will usually be a fair sample of what it will be in adult life. The hair will grow better afterwards if kept short for the first three years.

Water should not be allowed to enter a baby's ears, and any moisture noticed after the bath should be removed by the insertion of a scrap of absorbent cotton-wool, which, without any pressure, will dry the ear perfectly. It is a bad plan to try and clean the interior of a child's ear with soap and water, or with the screwed-up corner of a towel or handkerchief. These efforts only tend to push the secretion further in, until it at length presses against the delicate ear-drum, which is most undesirable. It must be borne in mind, too, that the ear-passage is very short in children.

Baby's Basket.

This is a great convenience. It should be large, stand high, and have one or more shelves beneath. It is well to have it made of brown wicker, as it keeps clean, and it is usually lined to match the cradle. A serviceable material is a pretty washing cretonne or print. It should have a pin cushion at either end, and several little pockets in the sides, to hold the smaller articles that are required. The basket should be completely stocked a week or more before baby is expected, in order that all may be ready when wanted. Baby's basket should contain a complete suit of clothes—as will be described—flannel apron, and six soft diapers.

The fittings proper should consist of:

Packet of antiseptic cord dressings and powder.
Packet of absorbent cotton-wool (2 oz.).
Packet of linen squares for washing the mouth.
Linen thread.
Needles, cotton, thimble, and blunt-pointed scissors.
Turkey sponge and square of flannel in sponge bag or box.
Best Castile or oatmeal soap in celluloid case.
Powder box containing zinc and starch powder in equal parts, or some preparation of talcum powder.
Pot of grease, *e. g.*, zinc ointment and vaseline, equal parts.
Large and small nickel safety pins.
Thermometer, for taking the temperature of bath, food or room.

Warmth and Quiet.

Two important points of baby management during its first weeks of life are **warmth** and **quiet**. It must be remembered that baby has, till its birth, been accustomed to a temperature of 99°, and though 60° to 65° F. is not too low for the air it is to breathe, only the face and hands should be exposed, as, at this temperature, it will rapidly lose its bodily heat and become chilled. This will affect the general nutrition, and, in spite of food, baby will not gain in weight. Baby should therefore be kept from changes of temperature, and not be carried about the house for a fortnight. After this time it can be gradually "hardened off," though much care is required in winter

Quietness is also of great importance, and should be maintained for some time. Baby should be but little talked to. This may sound harsh, but it is a necessary warning to young mothers. An excited babyhood leads to many serious nervous diseases in childhood, and it is a good plan for at least three months, to keep the little one away from a nursery full of brothers and sisters, all anxious to nurse and play with baby.

A THOROUGH PHYSICAL EXAMINATION

A baby if healthy is plump and should have a bloom like that on a ripe peach.

Physical Condition of the Child

HOW TO DRESS THE BABY

Baby's Outfit—Utility and Ornament—Anatomical and Physiological Facts—Position of the Lungs—The Brain—The Bowels—The Feet—The Skin—Material for Clothing—The Layette—Long Clothes—Short Clothes—Walking Clothes.

The question of baby's clothing is never left to be settled when baby has appeared. All a young mother's female acquaintances have had something to say upon this weighty matter, and a first baby generally finds an ample wardrobe awaiting it. But curiously enough, this wardrobe is adapted only for the first three or four months, and what is to be put on at the end of that time no one has troubled to think.

Now, in the months before a first baby is born, the mother often has many quiet days and hours; and did she but know how in a year or two she would look back with longing upon those same quiet hours, she would employ them with a little more forethought. "Learning by experience" is a thing that most newly married people get pretty well versed in after a time, and perhaps it may not be necessary, in this way at least, for some readers.

Baby's outfit for the first two years of life shall now be considered, and wise mothers will prepare some at least of the second stage garments.

What mother, rich or poor, does not like to see her baby dressed prettily? Do not some mothers, however, fail to see that true beauty cannot exist without fitness? Nature always teaches this. Animals belonging to cold countries have long, wooly, fur coats, while those belonging to hot countries have fine, thin, short-haired coats; both beautiful because both perfectly suitable. So should it be with clothing, and especially with children's clothing. "Trees is ornament, what we wants is utility" was the answer of an old man when asked why he was cutting down some beautiful old trees. There is some truth in the latter part of the sentence, whatever we may think of the former.

In the preparation of baby's wardrobe think first of utility, then of ornament.

Dangers Connected With Clothing.

Many a mother has lost her child through want of a little anatomical and physiological knowledge. Let us look at a few points.

1. **The Lungs.**—Most mothers are fully alive to the necessity of protecting a child's lungs, but how many know that the lungs extend **above** the collar bone on each side, and come down under the armpits? Did they know it, surely no child of theirs would go about a draughty house, much less the draughty streets, with such low dresses and short sleeves that both these important parts of the lungs are exposed to the risk of a chill, to be followed perhaps by severe bronchitis and death.

2. **The Skull.**—Every mother is alarmed, and rightly so, if her child falls on its head, for fear the brain should be injured; but how many are aware how thin the bony covering of the brain is? Did they know, surely they would not send their child out to play in the scorching sun, or to ride in a perambulator with a hat which is pushed far back on its head, leaving all the front part fully exposed. The brain, as a consequence, may become so irritated that congestion and fits ensue.

There is preserved in one of our museums a specimen of a baby's skull through which a cock has pecked a hole, showing how thin must be the bone.

3. **The Bowels.**—Many mothers are troubled by a constant diarrhœa or constipation occurring in their babies, who otherwise seem quite well. The cause seems a complete mystery, which is, however, easily solved, when it is remembered that a child's bowels are so delicate that the slightest chill may affect their healthy action, and that for this reason they require to be most carefully protected. Half a dozen petticoats with short waists will do no good, for if a child lie on its back and kick, the bowels will often have no protection at all. A knitted belt to reach from the hips to the armpits, and to which the diaper can be pinned, will cling to the child's body and avert all risks.

In older children a large expanse of thigh and leg left uncovered will lead to the same disturbances; flannel drawers, fitting closely just above the knees, will give the necessary protection.

4. **Tight Clothing.**—Chinese mothers are often condemned for such cruel bandaging of their children's feet as to stop their growth. In Italy the babies are firmly bound round and round with yards of material from head to foot, the arms being fixed to the sides, and are then placed on a pillow to be carried about like a parcel. When the time comes for them to walk, they cannot, as their legs are too thin and weak to support them, and even when they manage, after a time, to toddle along, their legs become crooked and bent.

American mothers are wiser than this, but even they do not always realize the mischief of tight clothing. Some babies are compelled to vomit their food, on account of their tight inelastic binders, which prevent the expansion of the stomach; while others cannot take a deep breath nor yawn without pain for the same reason. Some children, too, can only walk a little way because of the weight of their boots, or on account of their little toes being cramped up in an unnatural position.

5. **The Skin.**—Everyone has heard of the naughty boy who painted his dog all over, the poor creature dying in a few hours. But how many mothers have thought how important an organ the skin must be if the cessation of its functions causes death?

Many a child is unable to perspire properly and get rid of its extra heat, from the weight of non-porous clothing which has been heaped upon it, while many another has caught a chill from the contact of its skin with cold substances, e. g., linen, or cotton, soaked through with perspiration.

What Clothing Should Be.

These five points will show a thoughtful mother that the nature of a baby's wardrobe must not be left to mere chance to decide. It must be chosen and made up on clear, definite principles, principles, indeed, which involve the little one's health and comfort.

Thus, all important internal organs must be carefully protected from external changes of temperature.

Large surfaces of skin must be covered, as a superficial chill often causes internal disorders, and the greater the loss of heat from the exposure of large surfaces, the more will require to be generated internally to make up the loss, so that the food which ought to be making the little one fat and plump, is diverted into the production of heat to keep it alive.

All clothing should be porous and light, to allow the skin to act freely; and should, at the same time, be somewhat elastic, fitting the part closely but not tightly.

The material selected should be one that will retain the body heat to some considerable extent, especially remembering that the younger the child, the quicker it loses its natural heat, because the body surface is greater in proportion to the body bulk the smaller the child. Without doubt the substance that best adapts itself to these requirements is **wool**, and the well-known Dr. Jaeger's system is based on this theory. The very mention of the word "wool"

dispels the idea of muslins and laces, which seem naturally to connect themselves with a baby's outfit.

The Jaeger company sells a baby's outfit, or "layette," as it is called, composed throughout of wool, or one can be made at home

Scheme of Clothing.

A simple scheme of clothing for the first two years of life follows, based upon correct principles, and while it will form a sound foundation, each individual mother may improve upon it as she will.

The outline is given first, and a few explanations afterwards:

(*A*).—LONG CLOTHES—32 INCHES.

4 Vests of fine woven wool.
2 or 3 flannel binders and 2 woven belts.
4 Flannel petticoats or long flannels.
4 Woolen night-dresses.
4 Silk or woolen dresses.
6 Flannel squares or pilches.
24 or 36 Turkish toweling diapers.
3 Head flannels.
1 Shetland or knitted shawl.
1 Woolen hood.
4 Pairs of knitted shoes.
1 Veil.

(*B*).—FIRST SHORT CLOTHES—23 INCHES.

Larger vests of fine wool, knitted or woven, but with long sleeves and high necks, thicker in winter than in summer.
Larger belts, knitted or woven.
2 Pairs of flannel stays.
4 Woolen petticoats with bodices.
4 Night-dresses.
4 Silk or woolen dresses.
4 Pairs of Woolen socks with long legs.
24 Larger diapers.
6 Pairs of flannel or knitted drawers.
8 Bibs.

(*C*).—FIRST WALKING CLOTHES—21 INCHES.

3 Pairs of combinations.
4 Woven belts.
2 Pairs flannel stays for winter, or
2 Pairs flannel straps for summer.
6 Pairs knickerbockers.
4 Woolen petticoats.
4 Frocks.

The first list looks very meager when compared with the ordinary layettes advertised, but one advantage of a woolen outfit is that the garments do not crease so quickly, and they are also best washed at home. If the rule be followed that all clothing worn be first aired by an open window and afterward by a brisk fire before being again put on, the flannel garments will not need washing so often as those of linen or cotton; and one vest, petticoat, dress and night dress will thus often last a week.

(A).—Long Clothes.

Vests.—The best are soft woolen ones, being less irritating than the hand-knitted. They can be obtained at all good outfitters, with long sleeves and opening a short distance down the front, but some especially suitable for young infants, opening the whole way down the front, can be made to order. It has been amply demonstrated that muslin shirts are unnecessary even at first.

Binders and Belts.—A strip of flannel, 5 by 18 inches, is used at first, but woven belts which need no stitching are recommended after a fortnight. Good knitters can easily make them, as they resemble knee-caps.

Long Flannels.—These should be of soft, fine flannel—six yards making four petticoats. The bodices should have shaped shoulder straps which button and prevent the petticoat slipping down, or else be made with shoulder seams. Long flannels are generally embroidered all around.

Night Dresses.—These should serve also as a night gown and be daintily made. The material can vary with the season. For a winter baby, Eureka flannel is the best; for a summer one, gauze flannel, or a good nuns' veiling. The latter can be obtained at the stores or the larger dealers, and being of double width is very economical.

Dresses or Robes.—These, if care be bestowed on them, can be made as pretty as any mother can wish, and will be far more cozy and soft than starched muslin.

Gauze flannel, llama, a material resembling mouselline de laine, good nuns' veiling, fine cashmere, and washing silk, can all be utilized. Smocked fronts and wrists are always becoming to infants, or embroidered yokes and wristbands, with tucks and embroidery on the skirt and soft torchon lace as a trimming. A sash of the same material can be added if liked. **Silk** as a material for

outer garments can be recommended, as it retains heat much better than cotton, and has no starch to irritate the skin.

Flannel Pilches.—Welsh flannel is considered to be the best for these, which are about 27 inches square, and have button-holed edges.

Diapers.—Woolen diapers are advised by some, but provided they are frequently changed, fine cotton or Turkish toweling ones answer just as well and are less liable to irritate the skin. The latter need not be ironed, and are easily washed.

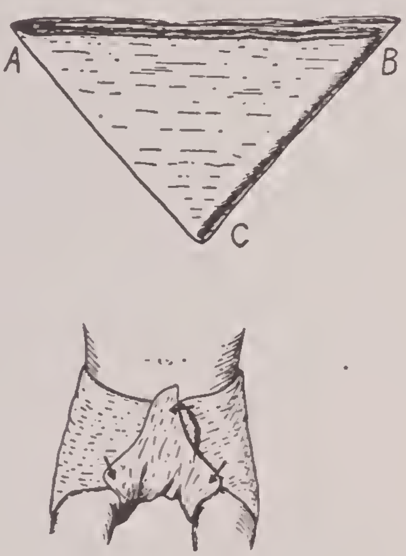


Fig. 231. How to fold a diaper or baby's napkin properly. The second figure shows how to put it on. The edge A B is brought around the baby's body just above the hips, as the baby lies on the folded napkin, on his back; cross A over B in front; hold these ends with the left hand and bring the point C up between the legs and fasten all with a safety pin inserted as shown by the upper arrow. Next insert safety pins at the sides as shown by the two lower arrows, tucking in the end A behind C. In cool weather it is best to fasten the baby's shirt down in front and include it behind C; the stockings may also be fastened up with the lower pins.

Head Flannels.—It is well to provide at least one of large size. Get a flannel 45 inches wide for this purpose, also one of 36 inches wide for the smaller ones.

Shawl.—A large white Shetland shawl is a delightful article, possessing the maximum of warmth with the minimum of weight; when soiled it can be cleaned to equal a new one, but it has the drawback of being expensive. A fine crocheted or knitted shawl is the best alternative, and answers for an outdoor wrap far better than the usual ornamental cloak hanging over the nurse's arm.

Knitted Shoes are generally presented in sufficient number by baby's friends.

Hood.—For both boys and girls this should be woolen, a simple one being made of a long piece of single knitting with large needles and Shetland wool. This is doubled over several times and the front rolled back and secured with ribbon.

Veil.—This is required in cold or windy weather, and should be of silk or wool. The practice of laying a linen or other handker-

chief over a child's face is most pernicious. A sunshade is needed in sunny weather.

An outdoor set, in which the cloak, hood, and robe are all one, has been devised and may be purchased or made at home. This can be easily slipped on over the other clothes, and saves time, as well as unnecessary movement.

(B.)—First Short Clothes.

These are generally needed by healthy children when ten or twelve weeks old in the summer, but not for a few weeks later in the winter. It is better to have a new long clothes outfit for each newcomer, with the exception perhaps of some of the long flannels, so that if expense be a consideration the short clothes can mostly be evolved from the long ones. It is important that the shortening be gradual, the clothes reaching four inches below the feet at first; and as baby ought still to be carried lying down quite flat, this length will be found to be convenient.

Vests and Belts may not yet require renewal, as they differ only in size.

Stays.—These are made of two layers of flannel, and may be quilted with a machine, thin in summer, thick in winter. The armholes are bound with flannel binding. They should cover the collar bone and reach to the hips.

Petticoats.—These are made with long-waisted bodices, the skirt consisting of a frill sewn to the bodice. The neck is high, and in very cold weather sleeves to the elbow are required. For summer wear, cashmere, nuns' veiling, or gauze flannel are recommended, and for winter, twill or Eureka flannel or one of the good unshrinkable flannels such as Viyella. The lower edge can be embroidered or trimmed with lace.

Night Dresses.—The long ones can generally still be used, though they may need new yokes and wristbands, but if they are made of the thinner woolen materials which were worn over long flannels, the latter must be retained, unless the weather be hot, when a vest beneath will be sufficient.

Dresses.—The long frocks can have a piece cut out above the tucks, an extra one being made to hide the joint, or, in a plain skirt, the hem can be turned up again and half a dozen tucks be put in. Smocks will generally have stretched sufficiently to last a few months longer, but yokes will probably require renewal. Later on,

when old enough to keep warm by playing, there is no necessity in summer weather for sleeves below the elbow; remembering, however, what has been said about the position of the lungs, the upper arm ought always to have a woolen covering. The colored unshrinkable flannels are very suitable for these dresses, as, though washing well, they require it less frequently.

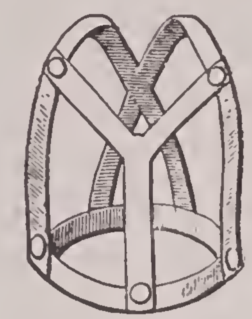


Fig. 232. A skeleton waist suitable for summer wear or for children.

Socks.—Those known as three-quarter length are best, and in winter should be worn as well as the ordinary wool boots. A little later small pieces of morocco leather or kid can be easily fashioned into dainty little shoes, and when a child can toddle leather shoes can be worn, but they must be very soft, with broad and thin soles. Shoes are better than boots for little children, as the ankles are not confined, with moderately thick soles for outdoor wear, and in winter gaiters to the knee. While a child is well wrapped up in a perambulator, the fewer outdoor garments the better, to lessen the wearisome operation of dressing to go out.

Drawers.—These, whether made of flannel or hand-knitted, should be worn over the diaper, buttoned to the stays, and reaching just above the knee. They obviate the necessity of a knitted petticoat, and are far superior in warmth.

(C).—Walking Clothes.

A child is generally ready for these at about two years old, some earlier, if they are forward and big for their age.

Night Dresses.—These should now give place to **pajamas,** made all in one to button at the back. They obviate all risk of cold, the child being unable to kick them off. Viyella is a good all-the-year-round material. It should be supplemented in winter by a long woven vest, worn beneath, as children generally lie with arms and upper part of chest uncovered.

Belt.—Same as before.

Combinations.—These should be of pure wool, woven or knitted, thick in winter, with high necks and long sleeves; thin in summer,

with high necks and short sleeves. They can be obtained with the lower part made to button up at the sides, and while reducing the number of garments required, are equally suitable for girls and boys.

Stays or Braces.—The former, which have already been described, can be replaced in very hot weather by straps of double flannel, 23 inches by 1½, stitched each side, with buttonholes at the ends, the knickerbockers having four buttons, two in front and two behind to correspond. The straps pass over the shoulders, crossing each other back and front, or behind only.

Knickerbockers.—Flannel or cashmere in winter, nuns' veiling in summer.

Petticoat.—This should be long waisted, resembling the short coating one.

Frock.—Let this be high necked, with sleeves to elbow or wrist, according to the season; made with a yoke into which the skirt can be gathered for girls, and box-pleated for boys, is the simplest method, while smocks are always becoming.

Outdoor Clothing for Children.

The more exercise a child takes when able to run about, the less clothing is required to keep it warm, perspiration tending to weaken the system and render it more liable to chills. Clothed in one layer of wool from neck to knees, with the additional protection of the belt to the sensitive abdominal organs, a child of this age in very hot weather only requires additional clothing for the sake of appearance. For this reason silk or cotton upper garments are generally preferred for summer wear in towns.

For seaside or country wear, when a child runs alone, and may choose to rest upon damp grass or wet sand, only woolen clothing is admissible, and the simplest garb consists of combinations and belt, flannel stays or straps, knickerbockers and frock. The two latter should be alike, and made of woolen beige or fine serge. The frock should hang straight from a yoke, confined at the waist by a belt into which, when crawling or paddling, the skirt can be tucked.

At this age it is of great importance that in summer the whole head should be well protected from the sun's rays. Large pith hats with turned-down brims can be obtained, which shade well and yet provide for plenty of air beneath. A cabbage leaf in the crown is a homely but useful precaution.

The Nursing Mother
and
The Nursing Child

WEANING AND DIET AT VARIOUS AGES

Nature's Food—A Mother's Duty and Diet—Treatment of Mother's Nipples—Regularity of Meals—Composition of Milk—Suckling—Cracked Nipples—Excess of Milk—Why Does Baby Cry?—Cramp—Colic—Hunger—Bottles—Twins—When a Mother Should Not Nurse Her Baby—Weaning—Diet Tables—Beef Tea—Variety in Diet.

It has become too much the fashion of late years for mothers deliberately to decide not to nurse their babies, quite forgetting that, having brought a child into the world, it is their simple duty to give to that child the nourishment which nature has provided.

It is wonderful to see how perfectly nature has adapted this nourishment to the every want of a child. For the first few weeks the mother has only the amount of milk that so young an infant needs; after a time she has more, and of a stronger quality, because the child needs it. When baby is about nine months old the mother's milk becomes poorer in quality and less in quantity. This is nature's sign that the child now requires more food than the mother can supply, and is an indication for her to wean it. This is as nature means it to be; but, sad to say, in an age of hurry and skurry, hard work and insanitary customs, it is very seldom practically realized.

How many pale, thin, weary looking mothers are met with, all their strength exhausted in the production of food for their infants, and this food unfortunately being only half as nourishing as the babies require; their puny condition bearing sufficient testimony to their lack of nutriment!

Such things ought not to be, and would often be averted by a

little more common sense and care, both before and after baby's birth.

A hand-fed baby's life is threatened with numberless drawbacks and dangers, to which a breast-fed baby is not exposed. Poor breast milk is, of course, worse than cow's milk; but the point to be striven after by every mother who is anxious to do her duty to her child is that her milk should not be poor, but good; and she should endeavor, by every means in her power, to provide nature's own nourishment for her helpless infant.

The Nursing Mother.

The average woman of the present day cannot fulfill this duty without a considerable amount of care. Even before the child's birth she must endeavor to place herself in as perfect a condition of health as possible; not by lying in bed, but by taking daily outdoor exercise, and by continuing her household duties. She should at the same time feed up well on simple articles of food, such as milk, eggs, fish, and meat. Some authorities, however, advise a very moderate diet at this time, and direct that the amount of liquids taken be limited, as it is thus possible to avoid such plumpness of the baby as may give rise to difficult parturition.

She should also prepare her nipples for the arduous duties so soon to fall upon them, by bathing them night and morning, for two weeks previous to the child's birth, with a mixture of equal parts of brandy, or spirit, and glycerine. Spirit alone makes the skin hard and liable to crack. If the mother have small and depressed nipples, it is well to pull them out regularly at the time of bathing them, and to carefully avoid any pressure upon them.

Years ago women were treated, after confinement, on the starving system; but this has proved to be a mistake. A mother who wishes to feed her baby must feed up well from the beginning. Supposing the child to have been born during the night—at eight o'clock the next morning the mother should be ready for a breakfast of bread and milk, or bread and butter with cocoa; at eleven, a lunch of beef tea and toast; at one, a dinner of poached or boiled egg and milk pudding, or bread and butter; at half-past three, a cup of tea with plenty of milk or cream in it; at half-past five, a cup of cocoa and bread and butter; and at half-past eight, a supper of beef tea, gruel or soup. During the night, a pint or a pint and a half of milk or gruel should be taken.

This kind of diet should be continued until the third or fourth day, when the bowels will probably have been relieved, after which, fish or meat may be taken for dinner and supper, and bacon or fish added to the fare at breakfast, after the preliminary cup of bread and milk, gruel, or porridge.

All food must be easy of digestion. Cooked fruit and vegetables may be taken in moderation, but pickles, acid drinks, highly seasoned dishes, and raw vegetables, carefully eschewed. Of course, excesses must be carefully avoided. The patient's appetite is a good guide as to amount of food.

The question of stimulants at this time is one upon which there is a diversity of opinion. Spirits and wine should certainly never be taken, except as a medicine; but if a woman is accustomed to beer or stout, one or even two glasses a day may prove beneficial. In a few instances stout, though not taken at any other time, may, if drunk at dinner and supper, promote the flow of milk by helping digestion. On the whole, great dislike to malt liquor is a sufficient reason for not having it, and in such instances, if persevered with, it has generally been found to disagree with baby. In these cases two, three, or even four pints of boiled milk, either given alone, flavored, or made thick with corn flour, barley, oatmeal, or rice, will do far more good, both to mother and child.

If a mother means to nurse her child she must count the cost. Hot places of amusement, irregular or late hours, must be resolutely abandoned, and she will be unable to leave home for more than two or three hours at a stretch unless she takes baby with her. Regularity in feeding is one of the great secrets in the successful rearing of infants, and must never be interfered with by pleasure.

The nursing mother should also avoid any excitement and worry. The character of the milk is often much altered by mental disturbances, and, in extreme cases, it has caused convulsions. Should a mother be much upset from any unavoidable cause, it would be well for her to draw off the milk with a breast pump before again allowing the child to take the breast. A bottle of boiled milk and water will do the child less harm than the disturbed milk of the mother.

After the first month, gentle outdoor exercise may be taken, but as the mother's internal organs do not return to their normal condition for about eight weeks, no severe exercise should be indulged in before that time. Some hours of each day should, however be spent lying in the open air, or well wrapped up before a widely opened window.

The good milk of its mother, then, is the best food for every infant, because it is nature's provision, suited for every want.

Human milk consists of certain substances, in certain proportions, which are necessary for the growth of a child. These proportions will vary slightly according to the richness or poverty of the milk, but a fair sample would give as follows:

Water	887	parts
Nitrogenous elements, *i. e.*, casein	23	"
Milk sugar	63	"
Fat	24	"
Salts	3	"
	1,000	"

These elements are in the exact proportions required to nourish a baby, and at the same time exist in such a state as to be easily digested by the infant. The first day or two after baby is born there is no proper food secreted, but a thin watery fluid which is called **colostrum.** This fluid has the purgative action which is required by the child, and which is quite sufficient for its needs, no butter and sugar, or castor oil, being called for.

If very hungry a few teaspoonfuls of slightly salted boiled water may be given until the milk comes, but usually it is not needed.

Nursing Baby.

A mother should nurse her child every four hours until her supply of milk comes, and afterwards every two hours **by the clock,** from 6 a. m. to 10 p. m. After 10 p. m. it is well from the beginning to accustom a child, unless exceptionally delicate, to go as long as possible without food; four hours is the usual time, thus it will come to its mother at 2 a. m. and again at 6 a. m. Some children are more easily taught this rule than others, but perseverance will always win the day. Infants' stomachs need rest, and night is the time for it.

On the second or third day the mother will probably be hot and restless, and will feel her breasts enlarge with the incoming milk. She should at once begin to feed the child regularly every two hours, giving each breast alternately, one side being sufficient for a meal. This plan of giving one breast at a time should be followed always. It secures a better quality of milk.

While nursing baby the mother should not sit up in bed, as that may cause faintness, but should have a second pillow to raise her a little, and turn slightly towards the side from which the child is going to suck. The infant's head should rest upon her arm, and she must put the first and second fingers of the opposite hand about and below the nipple, to prevent baby's little nose being so pressed upon it that it cannot breathe.

A vigorous baby sometimes nearly chokes itself in its haste, and it may be necessary to occasionally withdraw the nipple for a moment to allow it to get breath. A weakly child, on the other hand, may not suck strongly enough, but steady, firm pressure on the gland may cause a quicker flow of milk, and so assist the infant. Ten or fifteen minutes usually suffices for a meal, at the end of which time the child will generally fall asleep with milk escaping from its lips. It should at once be removed from the mother and placed upon its right side in the cradle. The right side is chosen, as the distended stomach will not then press upon the heart. It is of the greatest importance that the child's mouth should be then closed, and thus the good habit of breathing through the nose be early established.

After each nursing the nipple should be gently sponged with warm water, thoroughly dried, and then painted with the brandy and glycerine mixture. The slightest crack on the nipple should at once be treated, as, if neglected, it may lead to an abscess of the breast, and such intolerable suffering that nursing has to be abandoned. It is advisable, for a day or two, if any cracks have appeared, to use an india rubber nipple shield, enlarging the hole at the end of the teat that the child may get the milk easily. If there is great difficulty in making the child suck with a shield, the milk can be drawn off and given with the bottle. The crack itself should be kept thoroughly dry, be frequently painted with Friar's balsam or tannic acid in glycerine, and touched occasionally with a piece of blue stone, all applications being washed off before nursing.

For the first few weeks the flow of milk is about a pint in the twenty-four hours; in later months it may reach three or even more pints. Some mothers, especially at first, have more milk than the child can take, and it runs away, causing great discomfort. In such cases it is well to increase the solid, but diminish the liquid food, and to press the surplus milk out of the breast before the child takes it, as the milk which has been the latest secreted will be the best. It may even be well to draw off some of the milk with

a breast pump, if it be giving rise to fever, bad headache, or mental disturbance, but things usually right themselves in a day or two, and the demand will equal the supply.

A weakly baby will, as a rule, take less milk at a time than a strong one.

After the first six weeks two and a half hour intervals are not too long between each meal during the day, retaining the four or five hour interval during the night. A healthy child will sometimes sleep six hours at a stretch during the night, to the great advantage of the mother and child.

Baby's Cry.

The best exercise, or, indeed, nearly all the exercise, a new-born infant gets is crying, which should be required for a few minutes every day to keep the lungs well expanded. The cry is loud and long, almost a scream, and the face gets red or the whole skin may become rosy. A baby should cry from 15 to 30 minutes a day.

A cry that is too long or too frequent is a sign of something wrong. In this case the cry is not usually strong, but is moaning, worrying, or may be whining. **Pain, hunger, illness, temper** and **habit** are the causes of such crying.

The cry of **pain** is strong and sharp, but not usually very long. The face is much puckered, the legs drawn up and there are other signs of pain.

The cry of **hunger** is usually continuous, fretful, not strong or lusty, unless it is just temporary hunger, and not due to continued too poor or too little food.

The cry of **temper**, loud and strong and usually violent and the baby kicks and twists his body.

In **illness** the cry is moaning and fretful and real crying is easily caused.

The cry of **habit** or **indulgence** may be heard even in quite young babies, who are used to being rocked, carried about, to have a light, a "comforter," or a bottle to suck. The cry stops as soon as the thing cried for is given.

The baby should simply "cry it out," which may take an hour or two the first time, ten or fifteen minutes the next time, and will not often occur a third time. One must be sure, of course, that it is not the cry of some other cause. A baby will not rupture itself

from crying only, if it has a proper abdominal binder, and after it is a year old crying will never cause rupture, as the parts are then so strong.

Why Baby Cries.

Some mothers complain that baby is "always crying," and they therefore conclude it is always hungry; but, in point of fact, there are many reasons why a healthy baby may cry, and it may be well to consider a few of them. Baby may cry, because:

(1) It may have been too long in one position and is cramped.

(2) It may have a tight band somewhere, or a pin, with an unprotected point, running into it.

(3) It may be too hot or too cold.

(4) It may have the wind or the "gripes" (colic).

(5) It may be hungry.

Now, before supposing the last to be the case, unless indeed baby's food is really due, it is best to examine into the other four reasons.

The proper remedies will be:

(1) Turn baby over on its other side in the cot and turn its pillow.

(2) Examine its binder, also examine the safety pins and see that they are quite secure, of course, assuming that no one is allowed **upon any pretext** to put ordinary pins into the child's garments.

(3) Feel if it be hot and perspiring; if so take off a blanket or head flannel; if, on the other hand, it be chilly, take it up, warm it by the fire, wrap it in a hot blanket, and put a hot water bottle in its bed, before laying it down again.

(4) Place the child over your shoulder, patting or gently rubbing its back, or put it upon its stomach on your knee; if it brings up the wind freely it will be comforted, and probably drop off to sleep.

If this be insufficient, and the child's face be of a bluish hue, its eyes and mouth twisting, and its extremities cold, while its cry is peevish and in paroxysms or spells, give it half a teaspoonful of dill water in two teaspoonfuls of hot water, and the attack will probably soon be over. Should baby have brought up any sour smelling milk or curds, delay the next meal, even if due, for at least half an hour, so as to give the digestion a rest; of course, if the mother has been persuaded to give baby "just a little," it will

probably stop crying for a short time, simply because the warm fluid proves grateful, but very soon matters will be worse than ever. Why? Because the mother has been adding fuel to the flames; baby's digestion is at fault, and, instead of giving the stomach a rest she has given it still more work to do.

(5) The child will probably have just awoke from a sound sleep, and its cry will be loud and continuous, and it will take the breast eagerly and steadily.

If a child awake crying frequently, e. g., every hour, and yet has no symptoms of wind or sickness, and takes to the breast eagerly, the milk is probably poor in quality, even though it may be sufficient in quantity. The mother should, in such cases, try to improve the quality of her milk by taking more nourishing food, e. g., eggs, cream, milk, meat, etc., and, at the same time a tonic, e. g., extract of malt, may be beneficial if the appetite be poor. Fresh air, proper rest and exercise are also to be attended to.

The weekly weighing day must be considered the best criterion as to whether the milk be nourishing the child properly. If, week after week, there be no increase in weight, even though the child seem contented, a doctor should be consulted, who will probably examine some of the milk and decide if nursing should be given up.

A baby will sometimes take its food very well, but immediately afterwards will scream, draw up its legs, have a good deal of wind, and afterwards green diarrhœa. Here there is something wrong with the milk; perhaps the mother has eaten some indigestible food, or drunk something acid, or may need an aperient. Any such cause must be removed, but, if the same effect be continually noted, and the child does not gain in weight, it is probably one of those rare cases in which the mother's milk does not agree with the child, and it must be weaned or have a wet nurse.

Insufficient Milk.

It frequently happens that after the mother begins to resume her ordinary duties and get about a little, the supply of milk falls off in quantity, and the child cannot get sufficient to satisfy it from one breast. The quality is excellent, but the quantity is insufficient. The child will suck until it is tired, then doze off, and, at the first attempt to move it, will wake again and suck furiously; and then drop the nipple with rage at not being able to get what it wants. In this case the mother should arrange her food so as

always to have had some nourishment about half an hour before baby wants a meal. A glass of rich milk, some gruel, cocoa, or beef tea will assist.

If, in spite of all that can be done, the supply runs short, baby must have two or three bottles daily of diluted cow's milk, as will be explained later on.

It is a popular delusion that cow's and mother's milk do not agree. The mistake has arisen from the cow's milk not having been properly given. Let baby have every sixth or third meal from a bottle as is necessary, but let it be given regularly and systematically, or the child will suffer; thus, right breast, left breast, bottle, and so on. It must be remembered that every ounce of good mother's milk is a clear gain to the child.

On the other hand, a baby should have one bottle daily after three or four weeks, even though the mother have plenty of milk: otherwise, should the mother be unavoidably called away for a few hours, or have the misfortune to suddenly lose her milk, there will be great difficulties—a baby being a most conservative little person.

The nursing of a baby by its mother has, so far, only been considered from the baby's side of the question, and once again let us reiterate that it is of the utmost importance, at any rate for the first few weeks, that the little one should have that perfect nourishment which nature has provided for its use.

Sometimes, however, instead of one baby to be fed, there are two, and rare indeed must it be to find a town woman in the twentieth century who is robust enough to feed twins successfully. In such an event it is well to divide the breast milk between them, and give bottles alternately with the breast; if the one twin be more puny and weak than the other, it may be well to bring up the stronger of the two wholly by hand; but frequently the poor mother's horror at such a rapid increase in her family causes what milk there is to disappear, which unfortunately settles the question.

There are some conditions under which a mother should not nurse her child:

(1) If she is consumptive or markedly scrofulous.

(2) If she is suffering from an acute disease, e. g., typhoid fever, inflammation of the lungs.

(3) If she is in a state of great general debility.

(4) If, after a fair trial, she has excessive backache, faintness, continued prostration; or if her periods should return at all profusely.

Weaning.

Weaning, in a baby who, though breast fed, has taken one bottle at midday since a month old, will give no trouble. If the mother has been quite equal to nursing the baby and no bottle has been given, it is necessary to begin with one bottle a day. This bottle should be prepared according to directions given under **Bottle Feeding.** Should the mother's milk be exceptionally satisfying and produced at little or no detriment to her own health, weaning may be postponed for another couple of months. Some mothers go on nursing their children till they are fourteen, sixteen, or eighteen months old, but this is a grave mistake; bad for the child and still worse for the mother. **Early** weaning is necessary if the child is not thriving, not gaining in weight and developing normally, or if the mother become pregnant or seriously ill.

If weaning is begun at the ninth month, it should be by adding a morning bottle to the midday one, a week later by giving an evening one also, and then by quickly increasing the number of bottles, until, by the beginning of the tenth month, the bottle has been entirely substituted for the breast. At this age, supposing the child sleeps all night and takes nine or ten ounces of milk at a time, six bottles will be ample, as that will give nearly three pints of milk; but this is the maximum quantity, and a small child will probably only take two and a half pints. A diet list is given suitable for the eleventh and twelfth months.

If a child has not been accustomed to a daily bottle from an early age, weaning is apt to be a troublesome process. Should it be urgently required, it is best to do it abruptly, or endless will be the battles, and it will be best for the mother entirely to hand over the feeding of the child to someone else for a few days. Hunger will soon bring the child to the bottle; the food in this case must not be given strong at first, but mixed according to the table for a month or so younger, and then gradually increased. Should there be no special urgency, however, and the child be very obstinate about the bottle, it will be best gradually to teach it to drink out of a cup at once, and not try it with the bottle at all. Of course, it must be remembered that feeding by a cup is a much slower process than by a bottle, and unless the nurse or mother be very persevering, the child will not get its proper allowance of milk, and if it has much less than three pints at this age it will not get on.

Diet at Eleven Months.

7 A. M.	Modified milk, 10 ounces.
10 A. M.	Ditto.
1 P. M.	A lightly boiled egg with stale bread crumbs, and a cup of boiled milk to drink.
	Alternating next day with half a pint of beef tea or some gravy from a joint with stale bread crumbs; or a custard made with one egg to half a pint of milk.
4 P. M.	Same as at 7 A. M.
7 P. M.	Ditto.
10 P. M.	Ditto.

The above diet will give two and a half pints of milk without the portion at dinner. The food can be prepared twice in twenty-four hours as is most convenient, and each time must be placed in a perfectly clean jug, the morning and evening jugs being kept quite distinct and washed out thoroughly each time.

Mellin's Infant Food, Eskay's Albumenized Food, Allenbury's Milk Food or other artificially prepared foods **may** be used. Directions for making the various foods will be found on the tins or bottles. Modified fresh cow's milk is always preferable. Good cream added to the dietary is of great value.

Beef tea for young children is generally made as follows: Cut up in small pieces, free from fat, half a pound of beefsteak, add one pint of cold water, and a little salt, put it into a jar or jug, cover the top with brown paper, and stand it in a saucepan of cold water on the fire, allowing the water in the saucepan to simmer for two hours. Turn it into a basin and, when cold, skim off any fat that may rise. If necessary a little sugar can be added before it is given. A still better method, which can be adopted in the nursery, is to cut up four ounces of best rump steak into strips and finely shred them. Soak for fifteen minutes in five ounces of cold water with a little salt, then heat very slowly, stirring all the time till the thermometer registers 130° F. The juice will be all extracted and the meat left white. Strain and remove the fat by drawing tissue paper across the top. The albumin of beef tea coagulates at 150°, so it should never reach this heat.

At this age bovril may sometimes replace home-made beef tea with advantage, inasmuch as it contains certain of the nutritive properties of beef that are excluded from the latter. The special brand of "Invalid bovril" will be most readily taken, as it is devoid of seasoning.

Diet, From Twelve to Eighteen Months.

7 A. M. Milk, 10 ounces, prepared as directed under bottle feeding.
10 A. M. Milk, 10 ounces, with stale bread broken in, or a lightly boiled or poached egg, with stale bread crumbs and 8 ounces of boiled milk.
1 P. M. Beef tea or bovril with stale bread, and a saucer of custard pudding, or gravy and potato, which has been through a sieve, with a saucer of pudding.
4.30 P. M. Same as at 7 A. M., with a Mellin's or milk biscuit.
7 P. M. Ditto.
10 P. M. Ditto.

Diet, Eighteen Months to Two Years.

On waking (if early) milk food, 6 ounces.
8 A. M. Breakfast; milk modified, 10 ounces.
Lightly boiled egg and thin bread and butter.
11 A. M. Milk food, 6 ounces.
Plain biscuit, or crust of stale bread, with half a stick of best chocolate.
1.30 P. M. Dinner; beef tea or gravy, 10 ounces, with stale bread crumbs or toast.
Plate of milk pudding.
4.30 P. M. Tea; milk food, 10 ounces.
Biscuits; or bread and butter.
7 P. M. Supper; plate of milk pudding or cup of bread and milk.

As an alternative for the two principal meals there may be given:

Breakfast: 2 tablespoonfuls of well-boiled oatmeal or wheaten porridge, rizine, semolina, hominy, etc., with 10 ounces of boiled milk.

Dinner: half an ounce of underdone fresh butcher's meat well pounded up, or some white fish, or chicken, also potato or cauliflower well mashed, and plenty of gravy; baked or stewed apple and cream.

It will be seen that the staple article of a child's diet, viz., **milk,** is still to be given in large quantities; nothing can ever take its place for growing children of every age, and many children from a year old fail in strength and size simply from having left off their bottles, and not taking their equivalent in milk out of a cup.

Variety is to be aimed at in children's diet, but should not be carried to excess, thus: a small quantity of cocoa essence, such as Cadbury's, boiled in milk, may be enjoyed, as a change, at the 4:30 meal. The pulp of a well baked apple beaten up with sugar and cream, mashed strawberries or prunes, with cream and sugar,

bananas, the inside of grapes, the pips and skins being removed, or the juice of oranges, form useful and pleasant varieties after eighteen months; but **no indigestible parts** of fruit, or uncooked apples, gooseberries, etc., should be allowed to young children.

Bread and Butter, except in very small quantities, should not be given before the age of eighteen months, and then the bread should be thin, with as much butter rubbed into it as possible, **not simply laid on,** as this last is indigestible.

A properly brought up child will not soon tire of its simple milk diet, and should it dislike the meat there is no necessity to give it, until at least two years old; the great thing is that every child should have an abundant allowance of milk and plenty of animal fat.

No feeding between meals should ever be allowed, either in the form of biscuits, fruit, or sweets. On the other hand, a little chocolate or barley sugar, given at bedtime or directly after meals, can do no harm.

Should indigestion or feverishness occur, the child would better be restricted to its simple milk food for a day or two.

In some households it may be necessary to alter somewhat the hours, but the schemes above given may act as a guide to mothers upon which to plan their children's meals and food.

A big, forward child of sixteen months may require to be placed on the diet given for one of eighteen months; and **vice versa,** a small child of eighteen months may, with advantage, be kept on the diet given for a twelve-months baby.

After the age of two years, when children have generally cut all the milk teeth, a special diet is not required, but for two or three years afterwards, at the least, it is wise to see that **definite quantities of milk** are taken, two pints being the minimum, and to allow no seasoned dishes, no tea or coffee, mustard or pepper.

What to Feed the Baby

When the Mother Cannot Nurse Her Child

WET NURSE AND BOTTLE FEEDING

Wet Nurses—Composition of Human Milk—Composition of Cow's Milk—Casein—Boiling the Milk—Feeding Bottles—Necessary Apparatus for Artificial Feeding—Regularity of Feeding—Times of Feeding—Quantity of Food Required—Raw Meat Juice—Cream—Malted Foods.

Some babies are unfortunately deprived of the food that nature intended for them. What is to be done now? Two alternatives present themselves—a wet nurse or a bottle.

In ninety-nine cases out of a hundred a wet nurse is almost an impossibility, although the best substitute for a mother's milk is certainly that of a foster mother. But now that bottle-feeding has reached such a high state of perfection, wet-nursing is a far rarer thing than formerly. In some few cases, however, this may be the only way of saving a child's life.

A Wet Nurse.

A wet nurse should be about twenty-five years old, and have had a child previous to the present one; her infant should be a little older than the one she is about to nurse, and both woman and child should be examined by a doctor before she is admitted into the family. It is generally possible to obtain a wet nurse from a lying-in hospital or workhouse infirmary, but it is a great mistake to take a poor woman out of her usual surroundings and feed her up with better fare than she has had in her life, insist on her having a pint or two of stout, and give her nothing to do. Under this line of treatment the quality of the milk will quickly deteriorate, and baby will suffer.

Wet nurses usually require a great deal of looking after, and in big towns are often most unsatisfactory. They are apt to be untruthful, careless, and given to drink, and upset the whole household. Of course, a wet nurse can never have a mother's feeling towards the child, and, therefore, often takes very little interest in its welfare, simply performing her duties in a routine manner for the sake of the money.

By far the best wet nurses are respectable farmers' wives, and these often really merit the name of foster mother.

Artificial or Bottle Feeding.

Dismissing the wet nurse, then: How should a bottle-fed baby be managed? and, What is to be put into the bottle? In order that an infant may thrive, it is absolutely essential that it should have a food as nearly as possible identical with what nature provides. This artificial food must not only contain the proper elements, but they must also exist in the proper proportions.

There are three animals whose milk can be utilized for a human baby; the cow, goat, and ass; and the milk of all three contains the proper elements, though unfortunately not in the proper proportions. Compared with human milk they give the following proportions:

	Human Milk.	Cow's Milk.	Goat's Milk.	Ass's Milk.
Water	887	875	853	903
Nitrogenous elements, i. e., casein or curd	23	43	45	17
Milk-sugar	63	44	58	64
Fat	24	35	41	14
Salts	3	3	3	2
	1,000	1,000	1,000	1,000

Ass's Milk.—This milk being much weaker than human milk, is not suitable for a permanent diet, but it has the great advantage of possessing a casein which closely resembles human casein in character. It is therefore easily digested, and is very useful for quite young infants if extra cream be added.

Ass' milk is expensive, and must not be continued after a few months or the child will not thrive.

Goat's Milk.—This milk is very nutritious, being stronger than cow's milk in each constituent. Its casein, however, resembles that of cow's milk, and is equally difficult for a baby to digest. Goats are said to be **proof against tuberculosis,** which is an advantage, and their milk is much used abroad for infant feeding. If substituted for cow's milk in the tables given, the same proportions can be observed, but the extra cream omitted.

Why Cow's Milk Disagrees.

When a child swallows its own natural milk, as soon as it reaches the stomach it is met by an acid fluid which "turns" the casein of the milk into little solid flakes. These particles are quite thin and distinct from each other, and are digested by the gastric

juice, and absorbed through the walls of the stomach and intestines. When cow's milk enters the stomach, the casein, on the contrary, instead of clotting in tiny flakes, does so in large, hard lumps, which the gastric juice digests with difficulty. These hard lumps or curds often pass intact through the child's intestines, setting up vomiting and diarrhœa, as well as failing to nourish it.

The important fact of the different behavior of cow's or goat's, and mother's milk, can quite easily be demonstrated in the following manner: Place a sample of cow's or goat's milk, and another of human milk, in two glasses, and add a little acid, e. g., vinegar, to both. In the glass of human milk very little change will be visible, only some tiny little flakes of casein being thrown down, whereas in the other milk large masses of curd will at once be formed.

For young infants **barley** is a good mechanical aid to digestion, by breaking up the curd. It is used in the following way: Three teaspoonfuls of washed pearl barley (or one teaspoonful of patent barley) are put into two pints of cold water, and boiled down to a pint and a half and strained. This decoction is used instead of part of the water to dilute the milk, and must be made fresh every day, being poured into a clean jug ready for use.

Oatmeal, instead of barley, is useful where there is a tendency to constipation. Two tablespoonfuls of oatmeal should be boiled for four hours in one quart of water, and the liquid then strained through muslin, and used in the same quantities as barley-water.

If **gelatin** or **isinglass** be chosen, a piece about one inch square is put into four ounces of cold filtered water in a teacup, and allowed to stand for three hours. The cup is then placed in a saucepan half full of water, which is boiled until the gelatin is dissolved. When cold this forms a jelly, and one or two teaspoonfuls are put in each bottle.

Again, it must be insisted upon that foods given in this way, at so early an age, are simply to act mechanically in making the casein of the milk more digestible, by dividing it up and not in themselves to act as nourishment.

Healthy children of normal size, i. e., weighing over seven pounds at birth and possessing fair digestive capabilities, can deal with the casein of cow's milk if properly modified, especially if the mother is able to give the child a few meals a day of its own normal food.

Children must be fed as to quantity more by their weight than age; that is, a child weighing 9½ pounds at birth will require more

food than the table indicates; the best guide as to quantity is the way the child thrives and is satisfied or not.

It should be remembered that to change a child's diet because it has arrived at a certain age is not always wise. If it be regularly gaining weight, its flesh be firm, and it has a good color, there is no indication for any change, and many infants do splendidly on milk alone until twelve months old, and on simple milk and farinaceous diet until two years old.

If any change of diet produces indigestion, as shown by vomiting, colic, or diarrhœa, it is an indication to return to the simpler food, and later to make the change gradually.

Regularity in feeding is one of the most important details in the successful rearing of hand-fed children. This was dwelt upon when considering breast-fed babies; but if important with them, it is absolutely essential with bottle babies.

An ordinary infant that is not exceptionally delicate will require feeding in accordance with the following table:

Times of Feeding.

1 Week.	1 Month.	2 Months.	5 Months.	7 Months.	9 Months.
6 a. m.	6 a. m.	6.30 a. m.	7 a. m.	7 a. m.	7 a. m.
8 a. m.	8.30 a. m.	9 a. m.	10 a. m.	9 a. m.	10 a. m.
10 a. m.	11 a. m.	11.30 a. m.	1 p. m.	11.30 a. m.	1 p. m.
12 noon	1.30 p. m.	2 p. m.	4 p. m.	2 p. m.	4 p. m.
2 p. m.	3 p. m.	4.30 p. m.	7 p. m.	4.30 p. m.	7 p. m.
4 p. m.	5.30 p. m.	7 p. m.	10 p. m.	7 p. m.	10 p. m.
6 p. m.	8 p. m.	10 p. m.	3 p. m.	10 p. m.	
8 p. m.	10.30 p. m.	3 a. m. or when he wakes.			
10 p. m.	2.30 a. m. or when he wakes.				
2 a. m. or on waking, about this time.					

From the beginning, a long rest should be given to the child's stomach during the night. One bottle has, however, been allowed for in the table up to seven months, though many children will sleep from 10:30 p. m. till 6 a. m. before this. In this case the first morning bottle will require to be given rather earlier, and the other bottles may contain a little larger amount, or the requisite quantity will not be taken.

It is a good plan to always wake a healthy child, during the day, for its food, if due. After a short time it will awake punctually of its own accord. Until a child is eighteen months old it is wise to always take it up at 10 p. m. and give it some nourishment. It will then sleep later in the mornings, to the comfort of all concerned.

The food should not be kept warm during the night, but heated as required, as milk readily turns if kept warm, and it is almost sure to contain disease germs, which multiply when the milk is not cold.

Artificial or Bottle Feeding.

Fresh cow's milk is the only artificial food that can be used for a long time safely. The milk should be from several cows mixed, **not** from a single cow, because one cow's milk varies, but when mixed that of several even up to about a constant composition. Cow's milk must be not over 24 hours old (48 in winter) as ordinarily handled. With right precautions it may be used when much older. Cows' stables and milkers' cans and all utensils must be **clean.** The pails, bottles, cans, strainers, etc., must all be sterilized by boiling in water each time after use. The milk must be cooled immediately after leaving the cows and kept as cool as possible, at least not above 50° F. Milk that is properly prepared and safe may be bought in cities under the name "certified," "guaranteed," "inspected," "pasteurized," or "sterilized." It costs more but is well worth the extra outlay. When prepared at home the warm, fresh milk should be strained through a thick layer of absorbent cotton or several layers of cheesecloth in quart glass jars or milk bottles, and these covered and cooled at once by standing them in ice-water or cold water for half an hour. This rapid cooling makes the milk keep much better, very much better than when merely stood in a cool place. Bought milk should be similarly cooled or kept cool. Refrigerators should be of metal inside so that they can be scalded and thoroughly cleansed. A refrigerator may be improvised by covering a pail, or tin box having a lid, with felt or heavy quilting. If ice is used the bottles should be close against it or very near. The temperature should be tested with a thermometer and should be below 50° F. Spoiled milk is responsible for more trouble and acute illness than all other causes among bottle-fed infants.

Modified Cows' Milk.—Unaltered milk is known as "plain milk," "whole milk," "straight milk," or simply as "milk"; when changed it is termed "modified milk." Mothers' milk is the standard, being nature's best food for infants. Cows' milk differs from mothers' in (1) having a little more than **half as much sugar,** (2) having nearly **three times as much proteid (casein or curd) and salts**; (3) **being acid** instead of alkaline; (4) having **less digestible proteids,** and (5) **not being fresh,** hence much more subject to contamination with disease

germs, which increase in number as the milk gets older, is kept warmer and in proportion to the amount of dirt or dust which enters it. These defects of cows' milk are overcome by—

1. Adding sugar—better **milk-sugar,** or less cane sugar.
2. Diluting with water and then adding cream to keep up the right amount of fat; or by using top-milk.
3. Adding soda (bicarbonate of soda) or lime water.
4. Overcoming the lower digestibility by using more dilute milk and weaker than mothers' milk.
5. Keeping the milk clean and cool.

Cane sugar is sweeter than milk sugar and is apt to ferment in the stomach and cause colic. Only half as much of it as of milk sugar should be used, and for very delicate infants the latter is absolutely essential.

Top-milk is milk taken from the top of a bottle that has stood in a cool place some hours. "Ten per cent top-milk" is got by taking the upper **third** of a bottle (or other container with straight sides) that has stood four hours; "7 per cent milk" is got by taking the upper **half** of the bottle. The bottle may stand longer than four hours. The milk should be dipped out to avoid getting the lower part.

Cream is the part of the milk that contains most of the fat, but also has all the other constituents of milk. It is got by "skimming" (="gravity-cream") or by "separating" (="centrifugal cream"). Bought cream has 16 to 20 per cent fat. The upper **fifth** of a bottle has 16 per cent fat. Ordinary centrifugal cream has 18 to 20 per cent fat, while heavy centrifugal cream has 35 to 40 per cent fat.

Lime water is made by taking a lump of **unslacked** lime ("quick-lime"), putting it in a clean fruit jar filled with clean water, shake it up well, let it stand some time to settle, pour off the water (thus washing away the irritant **impurities**), then refill with clean water, shake, and let it stand till it settles clear. A scum will form, but can be broken and rejected.

Boiled water should be kept in a **clean** covered teapot or coffeepot that is not used for any other purpose. It should boil at least 15 minutes.

The powers and needs of an infant change with its age, and it is convenient to divide its age into periods, viz., **first period,** or "early months," birth to end of third or fourth month; **second period,** or "middle months," end of third or fourth to end of tenth or eleventh month; **third period,** tenth or eleventh month to fifteenth or sixteenth.

Food for the First Period.—Make up 20 ounces at a time usually. To make 30 ounces at a time use one half more of each ingredient; for 40 ounces, use double quantities. The following formulas give the right amounts:

FIRST SERIES OF FORMULAS—BIRTH TO FOURTH MONTH.

	I.	II.	III.	IV.	V.
Ten per cent milk (or upper third)..	2 oz.	3 oz.	4 oz.	5 oz.	6 oz.
Milk-sugar..........................	1 oz.	1 oz.	1 oz.	1 oz.	1 oz.
Lime-water..........................	1 oz.	1 oz.	1 oz.	1 oz.	1 oz.
Boiled water	16 oz.	15 oz.	14 oz.	13 oz.	12 oz.
	20 oz.	20 oz.	20 oz.	20 oz.	20 oz.

The amount of milk is progressively increased while the water is reduced, leaving the total amount the same.

Begin with Formula I on the second day, II on the fourth day, III on the tenth day, then more slowly to IV and V (IV at the sixteenth day and V on the twenty-fifth day), or yet more slowly for delicate children. As a general rule, **increase when the infant is not satisfied, but is digesting well** (as indicated by the appearance of the bowel movements on the napkin—yellow and free from curd, and no colic). It is well to increase the **quantity** first and later increase the **strength,** while giving the same quantity.

SECOND SERIES OF FORMULAS—FROM FOURTH TO 10TH OR 11TH MONTH.

	I.	II.	III.	IV.	V.
Seven per cent milk, or upper body..	7 oz.	8 oz.	9 oz.	10 oz	11 oz.
Milk-sugar..........................	1 oz.	1 oz.	1 oz.	¾ oz.	¾ oz.
Lime-water..........................	1 oz.	1 oz.	1 oz.	1 oz.	1 oz.
Boiled water	11 oz.	10 oz.	9 oz.	4 oz.	2 oz.
Barley gruel........................	0 oz.	0 oz.	0 oz.	4 oz.	5 oz.

Begin with I; in seven to ten days go on to II; in two weeks more change to III; in three or four weeks change to IV; in another three or four weeks change to V, which may be given for three or four months, only increasing the quantity given.

Third Period.—Tenth or eleventh to fifteenth month. After eleven months the sugar and lime water and boiled water may be gradually reduced, while the milk is increased to keep up the total amount, until finally plain milk is given. This is done by giving at first one meal a day of plain milk and barley gruel; later two meals, then three, etc. Thus an infant on Formula V (just preced-

ing) would now get five feedings of this formula and one of the milk and gruel; in two weeks he would get four of Formula V and two of milk and gruel, and so on till only milk is given. The milk and gruel are made up as follows:

For one feeding a day................	5 oz. plain milk and 3 oz. barley gruel
For two feedings a day...............	6 oz. plain milk and 3 oz. barley gruel
For three feedings a day..............	7 oz. plain milk and 2½ oz. barley gruel
For four feedings a day...............	8 oz. plain milk and 2 oz. barley gruel
For five feedings a day................	9 oz. plain milk and 1 oz. barley gruel
For six feedings a day................	10 oz. plain milk and 0 oz. barley gruel

The preceding formulas are for **healthy** children, not those who are sick or suffering from indigestion.

Always begin with a well-diluted food (by adding more boiled water), and increase the strength (by adding less water) every two days until the proportions are as given. This is in case of infants suddenly put on the bottle or just weaned. The **gradual** advance is as important as beginning weak. Increase the food when the infant is not satisfied with the quantity of food prescribed in the tables; is not gaining, yet digests well. Do not increase if the child gains 6 to 8 ounces a week. There may be slight discomfort for a day or so on increasing the food, but that soon passes off. In the early week increase the amount and the strength of the food alternately and frequently. Later—after the fifth month—increase the **quantity** chiefly. It is not unusual for the infant's weight to be stationary in the first 2 or 3 weeks. If it doesn't lose weight, is comfortable, sleeps much, has no colic, does not vomit, has normal bowel movements, all is going well. The bowels are apt to be constipated while the food is weak. They become regular of themselves when the food is strengthened.

The increase of food should be gradual and slow, but the **decrease,** in any indigestion, should be immediate and considerable. For a little disturbance remove 1 to 2 ounces of food from the bottle just before feeding and replace it by boiled water. For more serious disturbances dilute the food one-half. Return very gradually to the full strength or the indigestion will reappear.

Feeding Intervals and Quantities.—For healthy children during their first year:

	hours.	hours.	Meals in 24 hours.	One meal.	Total for 24 hours.
Second to seventh day..........	2	2	10	1 —1½ oz.	10—15
Second to third week...........	2	2	10	1½—3 oz.	15—30
Fourth and fifth weeks........	2	1	10	2½—3½ oz.	25—35

Sixth week to third month.....	2½	1	8	3 —5 oz.	24—40
Third to fifth month..........	3	1	7	4 —6 oz.	28—42
Fifth to ninth month..........	3	0	6	5 —7½ oz.	30—45
Ninth to twelfth month........	4	0	5	7 —9 oz.	35—45

The smaller meals are for small and delicate children. The interval is the time from the beginning of a meal to the beginning of the next.

An interval at night from 10 p. m. to 7 a. m. should occur without feeding.

Weaning should be completed at one year. In summer it is well to nurse a little longer and not wean in warm weather, although it may be better to risk weaning than continue nursing on poor and scanty milk. When weaning is done at the eleventh or twelfth month the child should be taught to drink from a cup or be fed with a spoon. In any case the use of the bottle should not be continued beyond the fourteenth month, except that the night meal, if given, may be from a bottle. A child of 9 or 10, when weaned, should have modified milk or artificial food suited to a bottle-fed baby of 4 or 5 months, to be increased gradually so that in 2 or 3 weeks the food is as directed for a baby that has always been bottle-fed. The baby may lose weight for a week or so, but this will quickly be made up when the stronger food is reached and the great risk of indigestion and much greater loss of weight will be avoided.

Sterilizing Milk.—There are two ways: 1. By **boiling** for one hour or one hour and a half. 2. By pasteurizing (Pasteur was a great French bacteriologist), i. e., by heating it to 155° to 170° F. for thirty minutes. This latter will kill all germs of typhoid fever, scarlet fever, diphtheria, or any form of diarrhea. The milk will keep sweet two or three days. The first method kills all spores, too, and the milk will keep a long time (two or three weeks) sweet if properly protected. The milk, of course, should be sterilized as soon as received, as once it is spoiled it can not be made fit again for food. The boiling makes the milk less digestible, more constipative, and less nourishing, so that scurvy may result from its exclusive use. It is a good way to prepare milk for a long journey, however. Pasteurized milk is quite digestible and unaltered in taste. Milk should always be cooled (whether sterilized or not) by straining it into bottles and standing these at once in cold water up to the height of the milk. Put as much milk in each bottle as will be prepared at one time. If possible, use only **clean, fresh milk,** without heating. When needed for use the baby's bottle should be stood in warm water (105° F.)

until it feels warm, but not hot when a drop or two is let fall on the front of the wrist.

APPARATUS NECESSARY.

The apparatus required for hand feeding is as follows:

A large tray.
An enameled basin.
Two feeding bottles with extra teats.
Three jugs holding 1½ pints each.
Ten-ounce measure marked in ounces.
Two-ounce measure marked in drachms.
An enameled or aluminum saucepan.
Strainer.
Thermometer.
Blue litmus paper.
Bicarbonate of soda tablets (3 grains each).
Lime water.
One yard of muslin.

A spirit lamp or gas burner will also be necessary.

The Tray is recommended so that everything necessary will be at hand and can be moved about as required. It should stand on a table close to a widely-opened window on the cool side of the house, away from drains or gullies.

The Basin is to be filled with water, and be large enough to hold the two feeding bottles, the two jugs, and little bottle of cream.

Feeding Bottles.—These should be devoid of tubes. In one of the American states it has been made illegal to use or sell bottles with tubes. The bottle should have a large teat to slip over its mouth. An opening to allow the entrance of air behind the milk, such as in the Allenbury bottle, may be useful. Teats will often require a cross-cut to be made with the scissors, if the child suck feebly. Several of these should be used in rotation, being kept in a strong solution of boric (or **boracic**) acid and just rinsed in boiled water before using. The opening should be large enough to allow the milk to drop from the inverted bottle.

The Jugs.—One to contain the boiled milk, another the barley water and another the boiled milk. They should have necks large enough to allow the hand to pass in entirely for cleansing purposes. The inside should have no grooves or narrow corners.

Ten-ounce Measure.—This will be needed when the quantities exceed two ounces.

Two-ounce Measure.—This must be marked in drachms to ensure

the exact quantities being given. The inaccuracy of spoon or cup measuring is responsible for many attacks of indigestion. Sufficient for one meal only should be mixed at a time. One drachm = 1 teaspoonful; 4 drachms = 1 tablespoonful or half an ounce; 8 drachms = 2 tablespoonfuls or 1 ounce; 20 ounces = 1 pint.

An Enameled or Aluminium Saucepan, to warm the food either by direct or indirect heat. The former is the quicker method, as the food itself is heated in the saucepan, but owing to the very thorough washing required afterwards it is not so safe as the indirect method. In this latter method the food is measured into the bottle, and then heated by standing it in the saucepan of hot water.

Strainer.—This should be of enamel, and is necessary to prevent any of the skin of the milk passing into the bottle.

Enameled saucepans, if used for heating by the direct method, must be carefully watched, as they crack easily, and small pieces of the enamel may be detached and pass into the feeding bottle. If straining is always carried out, of course no harm would follow. Aluminium saucepans, though more expensive, are free from this danger.

Thermometer.—The one mentioned in Baby's Basket Fittings is the best. The food should register over 100° in the saucepan, as the coldness of the bottle will reduce it several degrees. The thermometer can be slipped into the neck of the bottle just before the teat is drawn on. The food should never be given to an infant colder than 99°; and it may be necessary with a very young baby to reheat the bottle during the meal by standing it again in the saucepan of hot water. A "cosey" or cover to slip over the bottle to keep it warm is handy, especially in cold weather.

Litmus Paper.—This is useful to test whether the milk is acid. It is not essential, as only fresh milk that has been kept cool should be used. The lime water corrects the natural acid of cows' milk.

Bicarbonate of Soda.—This is useful in tablets of known strength. Three grains to each ounce of milk given for a few bottles on the first sign of indigestion will often arrest an attack.

Lime Water, made as directed, is better than the soda. See index.

The Muslin is to throw over the tray and all its contents to prevent dust, etc., falling into the milk.

Once a day all the jugs and bottles, basin, and tray, must be boiled 15 minutes in water and soda (soda bicarbonate or baking soda), and after each meal the bottle, teat, and whatever else was used in preparation must be well washed in hot water, and the bottle

and teat replaced in the basin of cold water. Too much care can hardly be exercised to maintain the most scrupulous cleanliness in everything pertaining to baby's food, as one drop of stale milk may cause putrefaction to occur in the whole of the next meal, and frequently sets up vomiting and diarrhea. Bottle brushes are not safe things to use; the bristles easily become detached and may be swallowed, and cases of lead poisoning have occurred from washing out a bottle with shot.

In the handling of milk or other food the fewer the utensils used the less likely is the milk to become infected or contaminated with disease germs. All bottles, spoons, cups, jugs, etc., should be cleansed by boiling in water with baking soda, a teaspoonful to a pint.

In **pouring into a bottle** one may avoid using a funnel by having a jug in which to prepare the food. Or from a cup or tumbler, one can pour into a bottle by tipping the edge of the cup against the back of a clean spoon held upright over the mouth of the bottle. The liquid runs down the spoon more readily than down the side of the cup and so avoids spilling.

The jug, cup, and all dishes used to prepare food in should have no deep corners or grooves, either inside or outside. The smoother and plainer dishes are the easier they are kept clean. White is always preferable because it shows the dirt and must therefore be well cleaned.

When giving a young child the bottle, the infant should be held in a half-reclining position upon the mother's arm. From five to ten minutes must be taken over each meal, and, if the child suck quickly, the teat should be momentarily withdrawn from the mouth occasionally. Twenty minutes is a limit for a meal.

The practice of sitting a baby up and patting it vigorously on the back in the middle of its quiet meal is a bad one. It may be well, when the bottle is finished, to raise the child for a minute or two before gently placing it in its cradle on its right side, but it should always be kept very quiet after a meal. It is sometimes necessary to move the child quietly or shake the bottle if the baby is going to sleep without taking his full meal.

This chapter will, it is hoped, give intelligent mothers and nurses a clear insight into the rational feeding of those little ones who are unfortunately deprived of the nourishment intended for them by nature, and if it is used as a ground plan it can be modified as occasion requires for the individual baby.

If the Baby Is Not Gaining

WHAT TO DO AND WHY.

Signs of Baby Thriving—Want of Cleanliness—Want of Air—Need of Proper Food—Irregular Feeding — Improper Feeding — Starch Foods — Malted Foods — Condensed Milk—Ass's Milk—Humanized Milk—Peptonized Milk—Bread Jelly—Meat Juice—Cream.

The two preceding chapters describe how a healthy baby should be brought up, but there are so many poor babies in the world that do not thrive, that it may be well to go a little more into detail. How does a mother know if her baby is improving?

Of course, the question can at once be answered in the negative if baby is getting thin and weakly, is repeatedly having attacks of vomiting, diarrhea, and colic, is perpetually crying and rarely sleeping; but though none of these may be present, we cannot safely say baby is thriving unless most of the following signs are noticeable:

1. A steady weekly increase in weight.
2. A firm condition of the flesh, and color in the cheeks.
3. A good appetite at meal times.
4. Long quiet sleeps.
5. General contentment, and vigorous exercise, which it takes by kicking and stretching.
6. The teeth appearing at the right times.

The point is, why does not baby thrive? In nine cases out of ten the diet has something to do with the mischief. It may, however, be that the child is starving for want of fresh air; there may be no ventilation in its sleeping or living room, and it may be kept too much indoors. This point has been fully dealt with elsewhere, but is again mentioned because of its importance.

Supposing, then, that baby has plenty of fresh pure air, is well bathed in warm water every day, is warmly but lightly clad, and yet does not gain, we must go back to the all-important question of diet.

There are, at least, four distinct reasons connected with diet why a baby may not thrive, and in only one of these can the fault be laid at the poor child's own door.

1. A want of cleanliness.
2. Irregular feeding.
3. Improper, including insufficient, feeding.
4. An unusually weak digestion.

1. The necessity for **cleanliness** has been fully treated of. But it is so very easy for a busy nurse or mother to drift into careless ways, quite forgetting that some remains of milk left in a teat or dirty jug may cause fermentation and set up vomiting and diarrhea. In summer weather this is especially true, and a superficial washing of jugs and cans is often the reason why the milk turns sour so soon.

2. **Irregular feeding** is sure to be followed by evil consequences. The stomach of an infant is a very delicate organ, and quickly resents being left empty for hours at one time, and at another having two or three meals put into it in quick succession.

Baby should be fed **by the clock,** and nothing should be allowed to interfere with this rule. It is a good plan at first to write out the hours of feeding on a paper and pin it up on the wall, to serve as a reminder, but a baby fed punctually very soon serves as a clock itself, yet the careful attention to the meal hour must never be relaxed.

3. But **improper feeding** is one of the commonest reasons why a baby does not "get on." Now, what are improper foods? A very proper food for the mother may be by no means so for the infant. A little thought would soon show this. Nature provides the food on which a child ought to live for the first nine months of its life, and if this be of good quality and quantity the child thrives.

It therefore follows, as before pointed out, that a child's diet must resemble its mother's milk as closely as possible, and it may be well to consider from this standpoint some of the foods often given.

Starch Foods.—These would include pap, i. e., bread scalded in water and a little milk added, arrowroot, cornflour, bread and butter, and most of the patent foods. Can any reasonable woman imagine that such things resemble mother's milk? Yet, with many mothers these are favorite forms of diet for their babies, and then they wonder that they are such puny specimens.

The main ingredient in the above-mentioned foods is starch, a substance that infants have no power of digesting. For starch to be digested at all, even by adults, it is necessary that it should be first converted into sugar, and this is effected by the salivary glands in the mouth and others lower down. In young infants these glands are not properly developed; and therefore while starch is a suitable food for adults, who have the power of digesting it, it is most unsuitable for infants, who have no such power, and its presence in a child's bowels only causes irritation and pain, and provides material that ferments and forms acids and poisons, while it affords no nourishment whatever.

Malted Foods.—In these the starch of different grains has been converted into grape sugar, which can be easily absorbed, and is valuable not only for its intrinsic nourishment, but also for its mechanical power of decreasing the size of the curd in cow's milk. Used in small quantities these foods are therefore very useful adjuncts to cow's milk, and after three months may be given freely. The same foods, however, if mixed with water only prove a starvation diet, and form a striking instance of improper feeding.

Condensed Milk.—Desiccated Milk.—Condensed milk is a favorite food with mothers, and, in very poor districts where good cow's milk is a rarity, may be allowable. The great thing necessary is to be sure the brand is one containing **plenty of fat.** Ignorant mothers often buy condensed **skim** milk, thus depriving their infants of one of the most important items in their dietary. The sweetened kinds contain a great deal of cane sugar, and babies become fat, but their flesh is soft and flabby, and their powers of resistance being weakened, any illness proves serious. The reason for this is that infants cannot take condensed milk unless freely diluted, the amount of sugar upsetting their digestion, and if much diluted both the nitrogen and fat are too much lessened in quantity to properly nourish the child.

This will be seen by comparing the proportions given below:

	Cow's milk and Water, 1 to 1.	Condensed Milk and Water, 1 to 14.
Nitrogenous elements (casein)	21	16
Fat	17	8
Sugar	22	27
Salts	3	..
Water	937	949
	1,000	1,000

A child obliged to be brought up on condensed milk will therefore require extra **nitrogen,** in the form of raw meat juice, and **fat,** in the form of cream or cod-liver oil, to be added to its dietary, or it will be taking an "improper food," and will run the risk of rickets, delayed teething, and scurvy.

Unsweetened condensed milk can now be obtained, which is better for the child, but being less concentrated is more expensive.

Of desiccated milks one of the best is the Allenbury, prepared in two strengths, and very useful in hot weather, especially in towns, where cow's milk is apt to quickly turn. But all condensed, desiccated and sterilized foods have the great fault of being devoid of the

fresh element which is a most important factor in the successful rearing of hand-fed infants.

After three months this lack can be supplied by the juice of oranges or potato gruel. The latter is made by well boiling a floury potato, passing it through a fine sieve, beating it up with milk till of the consistency of cream, and adding about a tablespoonful to several bottles a day. No mother, however, who can obtain good fresh cow's milk should rest content with condensed or desiccated milk as a permanent diet for her child.

If a voyage has to be undertaken with a baby, it is advised by some to begin with condensed or sterilized milk a few days before embarkation, that the child may have grown accustomed to the change of diet before its new trials commence. This seems like going to meet trouble, however, and "An evil deferred is already half cured."

Some babies; though their food cannot be called improper, do not have **enough.** These children cry out for food before the meal is due, and always seem hungry, and their napkins are seldom wet. Breast-fed babies always pass less water than hand-fed ones. More food must be given. But until a child is seven months old more than eight ounces should never be given at once.

The **quality,** not the quantity, may require increasing, and less water should gradually be added to each bottle until the child seems to be satisfied.

Instances have occurred of children continually craving for food: a doctor should here be called in, as there is probably something wrong.

4. The fourth possible cause is **an unusually weak digestion.** Some babies are born with very little capacity for digestion, and these, though fortunately not at all common, give a great deal of trouble to both mother and nurse, and require usually skillful treatment.

FOODS FOR WEAK DIGESTION.

Many mothers imagine their children suffer from weak digestion, when, all the time, the fault lies not at the child's but at the mother's door: she has been treating it wrongly. It is rare for a breast-fed infant to have any great amount of indigestion; it generally occurs in hand-fed infants, for reasons that can be easily understood from the preceding chapter.

Supposing, however, that food has been regularly given in proper

quantities, and of a proper quality, and that all other reasons for a baby not thriving can be excluded, and yet the child is continually suffering from diarrhea and vomiting, it must be concluded that the ordinary diet suitable for children with normal digestion does not agree, and that the child really has a weak digestion. Some change must be made, or it will go from bad to worse.

A good wet nurse would, of course, be the best thing to try, but this is usually quite out of the question.

Other alternatives will be:

Ass's Milk.—This milk having a casein closely resembling that of human milk is readily digested, and is useful for a short time, but should soon have extra cream added, and it must never be continued for a permanent diet.

Humanized Milk.—In towns this is prepared at the large dairies and delivered daily, as milk is not fresh enough by the time it arrives at the consumer's house to attempt its composition at home. In the country, if cows are kept, it can be prepared by an intelligent dairy-maid, as follows: Allow one pint of milk to stand six hours, take off the cream and put it into a jug, and add half the skimmed milk to the cream. Separate the curd from the remainder of the milk by means of rennet, and add the whey to the mixture in the jug, which is ready for boiling, and can be given to the child without further dilution. Should this agree, less and less casein or curd must be abstracted by leaving some of the curd in the whey.

Mothers who have understood the preceding chapter will at once see, that though half the casein has been removed and extra fat added, yet that the casein itself is unaltered in character, and they will therefore gather that though this answers admirably with some babies, there are others to whom even the diminished quantity of casein proves an insuperable difficulty, since the **quality** of the casein is the same. This applies chiefly to the home-made production, the dairies partially peptonizing their mixture.

Peptonized Milk.—In fully peptonized milk all the casein and some of the fat is digested before it is taken, and the milk is thus ready for immediate absorption by the stomach. This can be effected in several ways.

1. It can be bought ready prepared from the large dairies, who send it out in bottles.

2. It can be easily prepared at home by using Fairchild's **Zymine Peptonizing Powders,** which are put up in little tubes containing sufficient to peptonize one pint of milk. Put a pint of fresh milk and

5 ounces of boiled water in a clean jug or bottle. The water may be boiling or the milk may be slightly warm, but the temperature of the mixture must be 100° F. Shake into the jug the contents of one of the tubes. Put the jug into a deep saucepan or basin of hot water, temperature 110° F., and allow it to remain in a warm place from ten to fifteen minutes, at the end of which time boil it up thoroughly. The boiling stops the peptonizing or digesting process. Should the child be very ill, the process of peptonizing may be kept up for even longer than fifteen minutes, but in this case the milk will be rather bitter, and some sugar of milk must be added. It will require less dilution by one half than that given in the table for the child's age. Peptonizing pellets, or tablets, or liquor pancreaticus (essence of rennet) are also sometimes used to predigest the milk. Directions for use are given on the wrapper.

Either of these methods may be followed, and if carried out carefully, will, in ninety-nine cases out of a hundred, agree with the child, the milk when entering the stomach having only to be absorbed, there being no curds of casein to digest, and therefore nothing to disagree.

On the other hand it must be remembered that though it is the right thing to feed children upon predigested food long enough to tide over a difficulty and educate the stomach, it is equally wrong to continue it for any length of time. Any organ that has no work to do, wastes or atrophies. It has been clearly shown that a healthy kitten fed entirely on predigested food, fell a good deal behind, both in weight and stature, another kitten fed on ordinary milk. Children kept too long on predigested food do not gain weight and strength as they should, and their digestive organs become weaker instead of stronger, so that it is very difficult to make any change in the diet without a violent attack of indigestion.

Peptonized food should never be left off suddenly. One teaspoonful of the peptonized milk should be replaced by one of boiled cow's milk in each bottle for two days, then two teaspoonfuls can be tried, increasing by one teaspoonful every two or three days, until the whole of the peptonized milk is replaced by boiled cow's milk. If method 2 has been used, the peptonizing process must be diminished by several minutes every few days, until it can be dispensed with altogether.

IN CASE OF INDIGESTION.

A note of warning must be added on the subject of continually changing a young infant's food. Some mothers, who have not mas-

tered the essential principles of successful hand-feeding, instead of seeking medical advice on such an important subject, experiment on their unfortunate baby according to the advice of the latest visitor, and are surprised that the child's stomach resents such treatment. It must not be forgotten that an acute attack of indigestion, as shown by vomiting and diarrhea, may occur with a baby, as with an adult, from some transient cause, e. g., an error in cleanliness or in the temperature of the last meal; and the conclusion that the whole dietary is at fault is not to be jumped at. The acute attack should be treated by the **omission** of the next meal when due, to give the stomach a rest. In this case, however, give water to drink—boiled water—which may be warmed and have a small pinch of salt in it. A quarter of an hour before the second meal would be due, or earlier if the child appears really hungry, a dose of brandy according to the proportions in **recipe page 649 may** be administered, and the two following bottles should consist of weak barley-water with half the white of an egg beaten up in each. This will often act like magic, by washing out the alimentary canal, and the child will be able by the time the next meal is due to take it as usual, though it is wise to make the food rather weaker than before for the next few hours. Should this simple treatment prove insufficient, it will then be necessary to try one or other of the preparations above mentioned.

Bread Jelly.—In very rare cases milk in any form may have to be discontinued for a time, and the best substitute, says Dr. Cheadle, is bread jelly. This is made by taking four ounces of stale bread and soaking it for eight hours in some cold water, then taking out the bread and squeezing all the water out, putting it into one pint of fresh water and boiling it for two hours. This prolonged boiling breaks up the starch granules and converts some of them into sugar. The pulp must next be rubbed through a fine sieve, and when cold it will form a jelly. For a meal take a tablespoonful of the jelly and mix it with eight ounces of hot water, at the same time adding a little milk sugar. Bread jelly does not keep long, and very soon turns sour.

But a child cannot thrive well if fed on bread jelly exclusively; it does not contain nearly enough of the nitrogenous or of the fatty elements. Raw meat juice may supply the one, and cream the other, e. g.:

Bread jelly mixture, four ounces.
Raw meat juice, one ounce.
Cream, half ounce.
Sugar, as much as will lie on a dime.

The meat juice must not be added to the mixture while the latter is too hot, or its albumen will coagulate, in which state it should never be given.

The cream and meat juice may be gradually increased as the digestion improves. After a time a little boiled cow's milk should be cautiously added, e. g., a teaspoonful to the bottle, and then, if no harm comes, it may be increased, so that the stomach may gradually be educated to do its duty.

All cases of very weak digestion will give a great deal of trouble at first, and though a few hints have been given, it must be remembered that infants cannot be treated by a hard and fast rule, and what may suit one might kill another. Owing to this fact, doctors now sometimes prescribe the exact amount of fat, casein, etc., which they wish the child to have, and the milk is prepared accordingly by the dairy.

The rationale of the line of treatment which will probably be adopted by the doctor will, however, be now understood, and it is an axiom that needs no proving—that unless a child have a proper amount of food, containing the proper elements, in their proper proportions, and presented to it in a form proper for its own digestion, it cannot "get on."

INSTRUCTION THIRTY-FIVE—*Hardening Process*

Baby's Exercise and Sleep

HOW TO CARRY A BABY.

The Hardening Process—Carrying a Baby—Exercise—Crawling—Walking—Perambulators—Going Out for a Walk—Massage—Gymnastics—Sleep—Mid-day Nap—Hours of Sleep—Quantity of Sleep.

Exercise and sleep are two very important things in a baby's life.

For the first fortnight very little exercise is taken, except by an occasional stretch. After this time it begins to be necessary for the child's health; and that it is enjoyed is easily demonstrated by watching a tiny baby after its bath kicking out its legs and arms on the nurse's knee before the fire. At this age it should be carried in the nurse's arms for half-an-hour twice a day, in an adjoining room in winter time, and in the garden in summer.

The outside temperature should be at least 60° F. for a young infant to be taken out, and if born during the winter, it may be neces-

sary to keep it in for some months. If, however, the advice given on the subject of ventilation be carried out, the child will keep quite well and strong.

Carrying a Baby.—It should be remembered that at birth the spine is quite straight, but will bend in any direction that pressure be applied. The back, therefore, must always be well supported, and, even when older, a child should not be allowed to sit up too much, or the spinal column, being too weak to support the weight of the head and arms, will bend in the wrong direction. This is one of the many reasons why it is far better for a baby when awake to lie and kick in its cot than to be nursed and coddled.

The "hardening process" in vogue among some mothers is certainly not good for winter babies. Until a child is eight months old it should never be sent out on misty or very windy days, especially if the wind be in the east. After this time the child may be "hardened off slowly," as the gardeners say, until it can go out regularly every day. A thick, moist atmosphere should, however, always be avoided. Children with tender skins should have a little good vaseline rubbed on their cheeks before going out in windy or frosty weather, to prevent roughness, as a clear, soft skin is one of childhood's great attractions.

EXERCISE.

Because a child cannot go out of doors it must not be left without exercise; it should be wrapped in a shawl and taken into a room of rather lower temperature than the nursery, and carried about as before described. A tiny baby, if put on its back on a bed, will delight to kick and stretch its limbs. When old enough to run, the child should have a couple of well-aired rooms to run in and out of; if properly clothed it will keep quite warm and enjoy the freedom.

Probably it will shout and sing at the top of its voice, giving splendid exercise to the lungs. There is something wrong with a child who is always quiet; and, at suitable times, a good noisy romp is to be encouraged.

Crawling.—Children of ten or eleven months may be put upon the floor with a few toys, and will remain happy for a long time. Little knitted overalls, combining stockings and drawers, which will pull up over the feet and fasten round the waist, will admirably protect a child from cold. The draughts from beneath the door should be provided against before a child is put on the floor. Crawling seldom begins before the tenth month.

Walking.—Attempts at walking are generally made at a year old, but except in thin, wiry children, fifteen months is quite young enough to begin. Should a child's legs seem inclined to bend, no walking should be allowed until a later date; or, should bending occur after beginning to walk, the child must be resolutely kept off its feet for a time. To see a child of twenty months with bandy legs walking about everywhere, is a disgrace to its mother and nurse.

A child very easily tires; it trots about so much in the house that its strength should be carefully husbanded out of doors. About a quarter of an hour before bringing the child in, it may be allowed to get out of the perambulator and walk or run about, but half a mile is as much as any child of two and a half years should be allowed to walk at a time. It is a great mistake to discard the perambulator too soon. It should be used until the child is at least four years of age. Over-walking is said to play an important part in bringing on infantile paralysis.

Perambulators.—How should a young baby be taken out? This is a rather vexed question, as some people have a great prejudice against perambulators. The three-wheeled perambulators of the old style are certainly open to criticism, at least for babies under a year old, but the bassinette pattern, with careful using, is a great boon to both baby and nurse. As a matter of fact, baby is less likely to catch cold in a perambulator than if carried on nurse's arm. In the winter a hot bottle should be provided, and soft, warm wraps. The pillows should be soft, and baby be put flat on its back. In this way the child can be made as warm and cosy as in its cradle, with the great advantage of breathing purer air.

The child should be taken out for a walk proper, and not shopping or visiting. At first it should be kept out for an hour, and, later on, for two hours at a time. If baby goes to sleep, never mind, it will not hurt it; and, on warm summer days, it may be put in a perambulator in the garden, shaded carefully from the sun.

At six months old a child should go out twice a day, e. g., from 11 to 1 and 2 to 3:30, in the winter; from 9:30 to 11:30 and 3 to 5, in the summer.

Go-carts are great acquisitions to older children, they can take their turn in pushing and being pushed, and thus make their walk a source of enjoyment. To be silently pushed along in a perambulator for a couple of hours is dreary work to an intelligent child of two or two and a half. Whilst quite young, watching the trees wave about, and the carts going to and fro, was sufficient amusement, but now is

the time when a bright, intelligent nurse is an immense help. Children are always asking questions, and many a lesson may be unconsciously learnt while out for a walk, as to size, color, animals, etc., by drawing the child's attention to various objects, e. g., "Here is a big brown horse coming," or, "Look at that little white dog."

A large open space is a great gain to children, and should always be sought in their walks, as here the air is purer, not being contaminated by the smoke of the chimneys or the refuse of the streets. At the same time it should not be a gossip-field for the nurses, or an opportunity for their charges to mix with other children, who may come from fever-dens or vermin-filled houses.

Massage.—There is one form of exercise which little children should have frequently administered, and that is firm rubbing of the limbs upwards by the hand. This rubbing develops the muscles wonderfully, and the best time to do it is after the bath. It is specially useful in rickets.

Gymnastics hardly come into consideration when treating of babies, but a trapeze, fastened by ropes from a cross beam, is a most useful exerciser. The Swedish exercises are of great benefit to growing children, especially girls, as their muscular development is generally but little considered, and their amusements do not naturally partake of such an athletic character as those of boys. Tiptoe exercises as soon as a child can walk, followed by skipping a little later, should be encouraged if there is any tendency to flat-foot.

SLEEP.

How much a baby should sleep is a question difficult to answer in definite terms. Generally a sleepless baby is one that is delicate, or one that has been brought up badly. When speaking of good and bad habits, it has been shown how important is the early training of an infant with regard to sleep, and one can only look with pity on the nurse or mother whose bad methods of early training are bringing forth fruit in the shape of weary pacings to and fro, rocking and hushing the baby—and sometimes the "old baby," too—to sleep.

Little wonder is it that the mid-day nap is soon given up with these children; it entails far too much labor and time.

A well-brought-up infant will for the first fortnight generally sleep the whole time unoccupied by feeding and dressing, i. e., nineteen out of the twenty-four hours. At about three weeks or a month old, if encouraged to stay awake about an hour before bed-time, it will sleep better at night.

By two months old it will often be awake several times during the day for an hour at a time, but, if well trained, will be quite content to lie quietly in its cradle.

These periods of wakefulness will gradually increase until by six months a healthy child should settle off at 6:30 p. m., be taken up and fed at 10 p. m., and then sleep on till 6 or 7 a. m.; during the morning and afternoon it should have two good sleeps of one and a half hours each, but after 4 p. m. should be kept awake to make it sleepy by bed-time.

At twelve months, a baby should sleep from 6:30 p. m. to 10 p. m., and from 10 p. m. to 7 a. m., and have a two hours' sleep in the day, from 11 to 1, or from 12 to 2.

At two years, the mid-day sleep may be shortened to one and a half hours, if the child should awake at that time, but even when it does not go to sleep, the mid-day rest should be insisted upon till five years of age. When putting the child to rest, it is best to remove its dress and shoes and darken the room.

As a general rule, little children should have twelve hours' sleep at night. It is a mistake to put a child to bed too early, unless it be convenient for it to wake at an equally early hour in the morning Few children will sleep more than twelve hours at a stretch.

All through childhood a great deal of sleep is required, and ten hours is not too long before adult age is reached.

INSTRUCTION THIRTY-SIX—*Weight and Height*

Size and Weight of the Baby

WHAT THE AVERAGE INCREASE IN HEIGHT AND WEIGHT SHOULD BE.

Average Weight—Average Increase in Weight—Influence of Food on Weight—How to Weigh Baby—Average Weekly Increase in Weight—Weight of Premature Infants—Average Height—Average Increase in Height—Influence of Diet on Height—Circumference of Head—Circumference of Chest—Undue Enlargement of Head.

The weight of a new-born infant varies very considerably, the average being from about 6 to 8 pounds. The usual weight for a boy is about 7½ pounds, and that for a girl 7 pounds. A baby of 5½ pounds would be **below,** one of 9 or 10 pounds **above** the normal

© I.F.S.

WEIGHING THE BABY

The baby should be weighed regularly every two weeks and a record of its weight kept for comparison.

weight. Children have been born weighing 13 or 14 pounds, but this is quite exceptional.

How much will a child increase in weight in a given time? The answer to this question will depend to a great extent upon: (1) Whether the child is healthy; (2) whether it is able to digest its food; and (3) whether it gets the proper kind of food. Roughly speaking, a baby doubles its weight by the fifth month, and trebles it at the twelfth. It may gain at the rate of 1½ ounces a day for some months together, but this is certainly above the average.

Table I may be taken as an average increase in weight in the case of a baby weighing 7½ pounds at birth, and brought up on good breast milk. Table II shows the average increase in one brought up improperly on cow's milk, starch food, pap, etc.

	Table I.		Table II.	
	lbs.	oz.	lbs.	oz.
At birth	7	8	7	8
At 14 days	7	14	7	10
At 3 months	12	8	11	10
At 6 months	15	8	13	10
At 9 months	18	7	17	7
At 1 year	21	10	18	7

Or again, suppose the baby weighs 6½ pounds at birth, the increase should be somewhat as follows:

	Table I.		Table II.	
	lbs.	oz.	lbs.	oz.
At birth	6	8	6	8
At 14 days	6	13	6	10
At 3 months	9	5	9	0
At 6 months	12	11	10	7
At 9 months	14	4	11	9
At 1 year	16	7	13	2

The above tables are partly taken from Gerhardt, but have been modified from later cases. A child reared by hand and fed with suitable food, will thrive better and far outstrip one fed exclusively on poor breast milk. On the other hand, it must be constantly borne in mind, that for "getting on," nothing can by any possibility equal good breast milk.

WEIGHING BABY.

Every mother should possess a pair of scales sufficiently large to weigh baby. An infant's weighing machine is now made with a

basket to hold the child, which is very convenient. Many monthly nurses, and mothers, too, have a strong dislike to this proceeding, considering it unlucky and hurtful. Such prejudices are now, however, becoming things of the past.

The best way to perform the operation is to place the scales in front of the fire at bath time. A small cushion, or pillow, should then be placed in the scale pan to support baby's head, and a warmed flannel pinned round the naked child, who is then gently placed in the scales. It is well to put on sufficient weights beforehand to approximately reach the sum expected, thus saving time and shortening a proceeding that baby is at all times apt to resent. Properly managed, the whole thing can be done under a minute. Of course, the pillow and flannel must be weighed afterwards, and their sum deducted from the gross weight.

The most satisfactory plan is to weigh baby regularly once a week or fortnight, and to keep a chart for reference.

It is astonishing how a few days' diarrhea or sickness will affect the weight.

If, for several weeks together, baby's weight does not progress satisfactorily, some change in diet is almost certainly necessary. Weight, however, is not everything, for a child may be getting very fat and putting on weight most satisfactorily, and yet be in a very unhealthy condition.

During the first week of its existence a baby rarely increases in weight, but often actually diminishes. This is most marked the first two or three days, after which it may gain a little, so that, at the end of the week, it may weigh the same as at birth. A fair weekly increase may be taken as 6 to 7 ounces. In the case of twins, both are usually rather under size and weight, and often one is much smaller than the other.

PREMATURE BABIES.

Of course, if baby be born prematurely, i. e., before the ninth month, it will almost certainly be under weight, and, if much before its time, will be very small and difficult to rear. It speaks volumes for the care and watchfulness of a mother or nurse who has successfully reared a baby born at seven months. Such a child will probably weigh about 3½ pounds, and an eighth month baby about 4 or 5 pounds. An infant weighing under 3 pounds will not probably be long for this world.

Incubators or mechanical nurses are always employed in hospitals,

© I.F.S.

INFANT'S INCUBATOR

New arrivals requiring artificial atmosphere for further development get a healthy start in life by this method in modern lying-in hospitals.

consisting of a sort of glass box, in which the child lives, the temperature being kept up by hot-water pipes or bottles. The results with incubators are very good—the Maternité in Paris giving the following:

Baby's Weight.	Died.	Lived.	Total.
2 lbs. 3 oz. to 3 lbs. 5 oz....................	28	12	40
3 lbs. 5 oz. to 4 lbs. 6 oz....................	35	96	131
4 lbs. 6 oz. to 5 lbs. 7 oz....................	11	101	112

A very tiny baby requires special attention from the moment of its birth. It should be placed in a bath of hot water (temperature 104°) before the fire and washed whilst in the water, and be then wrapped up in a warmed flannel, gentle drying being done without uncovering the child.

A previously prepared coat of cotton wadding with holes for the arms should next be applied, and strips of wadding be wound gently round the arms and legs. The diaper must be placed inside the layer of wool. Over this coat should be placed more wool, and finally a soft woolen shawl (Shetland if possible). The child should be placed in its cradle between warmed blankets, which, with the exception of a small opening for breathing, must entirely envelop it. Hot bottles should be placed on each side and at the feet of the infant, taking care that two or three folds of blanket protect it from being burnt. The air of the room must be kept warm and pure.

The heat of the child must be maintained night and day by filling the bottles with hot water as soon as they become chilled. No handling should be allowed, except for the necessary changing, which should be done as seldom as possible. In about a week the wadding must be changed, and, if strong enough, another hot bath may be given. If the body is too weak to suck, the milk must be drawn off by a breast-pump into a warmed glass, and feeding managed by a spoon or pipette every hour or two. If no breast milk is available, half this mixture should be given every hour or hour and a half by means of a pipette.

Fully peptonized Milk............	2 drachms
Barley water....................	5½ drachms
Milk sugar......................	¼ drachm or 15 grains
Cream	½ drachm

Quality and quantity can be cautiously increased after a week or so, and raw meat juice may with advantage replace the peptonized milk in two or more meals each day.

Such infants are often fed by "gavage," i. e., by passing a soft rubber tube down the throat connected with a funnel, into which the food is gently poured. Oftentimes brandy is necessary. At the end of about six weeks, if the child has got on well, it may be treated as an ordinary baby, but will require special care for months, or even years.

Premature children will, of course, be backward in teething, walking, etc.

HEIGHT.

What height ought baby to be? Here again babies vary very much. The average height at birth is 19 or 20 inches.

Just as proper food has its effect on the weight, so has it also on the height. Table I shows the average increase in height of a baby brought up on good breast milk, and, when weaned, brought up on proper food; by its side is shown the height of one brought up on improper food.

	Table I.	Table II.
Birth	20 inches	20 inches
6 months	27 inches	25 inches
1 year	31 inches	27 inches
4 years	37 inches	35 inches
6 years	43 inches	41 inches

The above is only an average; a child of tall parents will, in all probability, be taller than one of short parents, and vice versa. A good instance of the influence of the size of parents upon their offspring is seen in the case of the Nova Scotia giantess, whose baby weighed 23¾ pounds and was 30 inches long.

HEAD AND CHEST.

In new-born infants, the greatest circumference of the head is more than that of the chest taken just below the nipples. At a year and a half or two years the two measurements should be about equal, after which time the chest increases in size much more rapidly than the head.

	Head.	Chest.
3 days old	14¼	13½
6 months	17	16
1 year	18	17¾
2 years	18¾	18¾
4 years	19¾	20½
12 years	20½	24

AN AFFECTIONATE GOOD-NIGHT

INSTRUCTION THIRTY-SEVEN—*The Bed*

Baby Should Have Its Own Little Bed

WHERE SHALL BABY BE PUT?

Suffocation—The Cradle and Bassinette—Bed Clothes—Nursery—Night Nursery—Ventilation — Pure Air — Cubic Space — Temperature — Cleanliness — Drainage —Quarantine—Infection—Disinfection.

Some years ago it was always thought that, for at least the first month of its life, a baby should sleep in its mother's bed. This was a very bad habit, for the child breathed hot, impure air, and it veıy often led to too frequent feeding. Sometimes, too, the terrible accident of suffocation happens from the mother during sleep pressing the infant too closely to her, or partially turning over upon it.

THE CRADLE OR COT.

From the very first day of its life a baby should have its own little bed, bassinette, or cradle (which, however, should never be a rocker). Unless standing high of itself, it should be placed on two chairs to keep it from drafts.

It should be lined, and have curtains at the head, and should contain a mattress, a soft pillow with a fine calico or linen pillow-slip, an under blanket, a pair of soft top blankets, and a knitted or eider-down quilt. No sheets are needed.

As shown elsewhere, **wool** is the best warmth-retaining material that there is, and babies need this in a very great degree. If the weather be very cold, an india-rubber or stone hot-water bottle should be placed in the cot, but with two thicknesses of blanket between the child and the bottle. A baby can generally sleep in its cradle till nine or ten months old, and then a crib should be obtained, made with high sides, which are the same height all the way round, and which, if possible, let down. It should have a woven wire mattress, with a thin hair mattress above it, and be made up in the same way as the cradle. A piece of india-rubber sheeting put beneath the under blanket will protect the mattress. For the sake of appearance a sheet may be put over a blanket, and be turned back over the quilt, which should still be very light. No heavy clothing should ever be found on a child's bed. If expense be a consideration the cradle can be dispensed with, and a small sized iron or brass cot used from the first. The side near the mother's bed can be left down altogether until the child is old enough to turn about.

A hammock, or swinging cot, is very handy. It can be slung to hang over or just beside the mother's bed.

It is a good plan to stretch netting over the top of the cot to prevent a child standing up and overbalancing. Many broken limbs have been the result of neglecting this important precaution. Nets are sold for the purpose, or can be quickly made by a netter at home with bright color macramé thread. A covering of mosquito-netting in summer is good to keep off flies, which are not only annoying but particularly dangerous. The bedding and bed clothes should be placed before an open window every day for an hour to thoroughly purify them. On wet days this should be done before a brisk fire.

THE NURSERY.

The Room that a child is to occupy, both in the night and day, must be carefully considered. For the first fortnight of its life baby will probably stay in its mother's room, but afterwards, if it can be managed, it is best to set apart a room for it—the nursery.

This is the most important room in the house, and should be chosen with care. It should be high up, though not exactly under the

roof, face the south or west, and be lofty, for it should abound in air and sunlight, without which it is impossible to rear healthy children.

Wherever possible there should be a night as well as a day nursery, which much simplifies matters of ventilation; but where there is only one child, one room is frequently all that can be given up to it. In the latter case, twice every day the child must be taken into another room, and the doors and windows of the nursery thrown wide open for an hour to change the air in every corner.

Pure Air contains a large amount of oxygen, which we inhale every time we breathe, exhaling at the same time carbonic acid gas. Oxygen is essential to life, whilst carbonic acid gas is poisonous. It will thus readily be seen that in a room filled in the morning with pure air, and inhabited all day by persons taking in the oxygen, and replacing it by carbonic acid gas, unless the room be well ventilated the air will become more and more impure, until at last it is positively dangerous to life. Many babies have lost their frail little lives from lack of this knowledge on the part of their parents. Therefore, if a child is to inhabit the same room as its parents by day and night, it follows that very great care will have to be taken to keep the air in that room fit for the little one to breathe.

Ventilation.—In order to secure proper ventilation without draught, it is necessary to allow a space of about a thousand cubic feet for each grown-up person. The cubic space of a nursery can easily be found by multiplying its height, length, and breadth together, though, of course, any furniture, especially if bulky, will take up room and make the available space less. Supposing the height of the nursery be 10 feet, its breadth 14 feet, and its length 20 feet, that would give $10 \times 14 \times 20 = 2{,}800$ cubic feet, which would be ample for a nurse and two children.

Although a nursery be quite large enough, there must, at the same time, be proper ventilation. What is proper ventilation? It is an adequate change of air without draughts, and for this it is necessary to have a way for the impure air to go out, and a way for the fresh air to come in. The open chimney, especially when there is a fire, answers for the first, and the opened window for the second.

The window may be kept constantly open without causing a draught, by having a piece of wood, six inches high, nailed to the lower sill in front of the sash. The lower sash is then opened three inches or so. Provided there is no direct draught, the windows should also be drawn down about three inches from the top. Tobin's system of allowing air to enter by shafts, six or seven feet high, placed round

the room, is very good. The atmosphere of the nursery can thus be kept fairly pure, but the systematic airing twice a day must still be attended to. In very cold weather, after the airing, the room must be thoroughly warmed before a young baby is readmitted.

The windows, which should be low so that the children can see out, must be protected inside by railings to prevent accidents; and a fire, well protected by a guard, is far better than a stove.

A thermometer should be kept in the nursery, and the temperature maintained at about 60° F.

The nursery floor should, if possible, be covered with cork carpet or linoleum, and a large square of carpet be placed in front of the fireplace. There should be very little furniture, and, if it can be managed, another room should be used for the nurse's dressing room, where she can keep her own clothes, baby's washing apparatus, all soiled linen, etc.

The floor should be washed over every week, and dusted every morning.

If the walls can be painted it is the best thing to do, but if not, sanitary wall paper, which can be washed, should be used. Bright colored pictures should be on the walls, and a swing fastened to a cross-beam is a great amusement.

No Food should be kept in the nursery, especially milk. Slops of all kinds must be removed immediately, as they contaminate the air, which, it cannot be insisted upon too often, must be kept as pure as possible, especially in stormy weather when the children are obliged to remain indoors.

Every intelligent mother will now be able to frame rules for the proper ventilation of the children's living and sleeping rooms, and will, of course, see that the more people there are in a given space, the oftener will the air require to be changed, because the quicker will it get polluted.

Gas Burners use up a great deal of oxygen, and should never be kept lighted when the children are asleep. A night light is quite sufficient. Small safety reflector lamps, which leave the room dark except where the light is needed, are very useful.

The Drainage of the house is of great importance, and no pipes should be allowed to enter direct into the main sewer. Untrapped or improperly trapped pipes are a very fertile source of illness, often causing diarrhea, sore throat, diphtheria, low fever, etc.

THE INSTRUCTION OF A CHILD

A child should be taught with care and patience by the mother and the necessary training imparted by degrees.

The Moral Training of Children

Begin When They Are Infants

SELECTION OF A NURSE.

A Good Nurse—Qualities of a Good Nurse—Cleanliness—Tidiness—Method—Moral Training of Infants—The Force of Habit—Baby Comforters—Contentment—Toys—Lessons—School—Obedience—Punishment—Truthfulness—Loving Kindness—Usefulness—Gentleness—Nursing of Sick Children—The Sick-Nurse.

It has often been said that the best nurse a child can have is its mother, but this is by no means always true.

A good nurse must possess certain qualities, whether she is the mother of the child or not.

The Nurse.

If a mother can afford it, and especially if she is young and inexperienced herself, it is better not to choose too young a nurse for her first child; and she should give the preference to one who has had the care of quite young infants previously. A good nurse will always gladly learn the best methods of managing and bringing up a child, and should never be above learning from her mistress; neither should any mother be above learning from her nurse.

A really competent nurse is an unspeakable treasure to a young mother; but if her views on ventilation, artificial feeding, etc., be erroneous, her ideas must not be blindly followed. A nurse should never be ashamed to confess ignorance, which is far better than to hazard a confident opinion upon a subject of which perhaps she knows nothing.

A good nurse should possess a **strong love for children,** simply because they are children, and should prefer being a nurse to anything else. A person who has this characteristic is rarely lacking in the second all-essential quality—that of **patience.** To lose one's temper with a naughty child is a fatal mistake.

The nurse must also be perfectly **trustworthy, obedient,** and **truth-**

ful, or how can she teach these qualities to her charges? Many a child has had his first lesson in deceit from his nurse saying: "I will give you so and so, if you won't tell"—or from seeing things done, when the mother is absent, which would not be thought of were she at home. She should be perfectly **healthy**; one who is markedly scrofulous or consumptive may act as the innocent cause of a child's ill health or perhaps death.

It may be useful here to mention that nurses are often seen in the streets, parks, and public promenades, ostensibly in charge of children, but who are reading, chatting to other nurses or acquaintances, looking into shop windows, or even doing a little shopping on their own account. Some even go so far as to take their little charges on visits to their friends or relations. Now a person who will do any of these things, except by special permission, is quite unfit to be entrusted with children; she cares more for herself and her own pleasure than for the little ones under her care. Many a case of bronchitis or fever has arisen through carelessness in one of these respects, and it is wise for every mother to make strict rules on this subject which, if wilfully broken, should lead to dismissal.

Young children should never be taken shopping, if it can possibly be avoided; but a nurse should always feel that, when necessary for herself, she has only to ask permission, and it will be arranged that she shall go out quite free from responsibility of the children.

A good nurse is, or ought to be, a second mother to the children, so that, when away, their real mother may leave them in her care with perfect confidence that the welfare of the little ones is in safe keeping. Such a nurse should have her authority always upheld, and if she be perhaps wrong in some little question of nursery discipline, this should be pointed out to her afterwards, and not before the children. Mother and nurse should always act as one, and a nurse should always inform the mother at once should she notice the slightest thing unusual in the children under her care.

Cleanliness, tidiness, and method are also very important qualities in a nurse.

Cleanliness in her person, and in every corner for which she is responsible, be it a child's ear or a nursery cupboard.

Tidiness—or otherwise the nursery will soon degenerate into a scene of indescribable confusion. Drawers and shelves should each be in perfect order—a place for everything, and everything in its place.

The Training of a Child

Cannot Begin Too Early

The training of a child, whether by mother or nurse, cannot begin too early. The popular idea of reserving the training of a child until it can talk, is utterly wrong.

Infants are creatures of habit, good or bad habits being easily formed, but not at all easily broken. Baby, when only a few days old, may have formed the habit of sleeping beside its mother, and obstinately refuse to go off in its cradle. It may have formed a habit of waking and crying to be fed every hour or two during the night, and yet sleeping three or four hours together during the day. A little later on it may have formed the habit of never going to sleep without being rocked in the arms—a very troublesome habit indeed, when the household has resumed its busy round, and baby is no longer everybody's first thought.

To **form good habits** in baby is, then, the first step in its moral training, and, as before said, cannot be begun too soon. Good habits are as difficult to break as bad ones.

Sleeping.—Regular feeding has been already mentioned, and is most important, but a few words must be said on "getting a child to sleep." A healthy infant will at first sleep nearly all the twenty-four hours; it requires very little exercise, i. e., nursing and dancing about, and the quieter it is kept the better. After each meal it ought to be laid in its cradle, whether asleep or awake. It should be a rule that, after each meal baby should lie down for at least half an hour, and be left quiet.

For the first seven or eight months the child, if treated in this way, will generally take a long or short sleep, just as it feels inclined, after each meal. A child made to lie in its cradle except when being fed, taken out of doors, or occasionally nursed, will very rarely give any trouble when bedtime comes. When sleepy, it will go to sleep, and when wakeful, it will lie and kick about and coo to its heart's content, taking far more exercise, and being just as happy, as if always being nursed. The child will thus form a habit of loving its cradle, instead of hating it as so many do. Never

accustom a child to being rocked to sleep, and never wait by its bedside while it is settling off.

Sometimes, of course, a baby is chilly, either from careless bathing, or exposure, and then it would be cruel to put it down in a cold cradle—wrap it up in a blanket, and thoroughly warm it by the fire, and then it will go off happily enough. Never forget the grand rule of putting a child into its cradle directly after each meal.

Cleanliness.—Next to good habits in feeding and sleeping, comes the good habit of cleanliness. Here, again, everything depends upon regular perseverance. The child should systematically be held over a small chamber before a fire when being changed, and at two or three months old, immediately after each meal. At this age, the habit of going awake into its cradle will be firmly established, and the little intervening incident will make no difference, so long as it is quickly performed, and the child laid down directly afterwards.

A baby, if healthy and given to good habits by proper training, is a very contented little creature. Until five or six months old, the pleasure of kicking and playing with its hands and feet is all-sufficient, though it may be increased by a rattle or a bright-colored object being suspended over its cot. After this age, an india rubber or rag doll will amuse for hours, but the child should not be allowed to sit up to play until nine months old, and then only very occasionally. If tired of lying flat, the child must be well bolstered up with pillows.

Baby Comforters should never be tolerated, and it shows a defect in nursery training when a child in a perambulator is obliged to be pacified with such a device. They are stated on good authority to be one of the chief causes of adenoids. The continual sucking also causes an increased flow of saliva, which is too useful a fluid to be wasted in this fashion. On the other hand, baby's natural comforter—his thumb—may be permitted in reason, as it will often be only sucked when going to sleep. At about ten or eleven months old, baby will probably learn to crawl, and with a few toys will be good for a long time, especially if it can watch older children at play. Soon after a year old, baby will learn to walk a little, but the exact date for this accomplishment varies greatly for different children.

Toys.

Contentment is a great virtue to be cultivated in the nursery, and no good nurse will tolerate continual crying and whining; indeed,

as a rule, they are the result of having nothing better to do. A child will often amuse itself for a long time by running around the table, singing as it goes, and when tired of that will be ready for some toys. A nurse should husband her resources, and should never allow all the toys to be had out at once. It is a good plan to keep certain toys in reserve for wet days, e. g., a doll's cradle with its bed clothes and doll inside, or a set of tea things, with scraps of chocolate and sugar.

Most children, as soon as they can run, enjoy toys which they can push or pull about after them; strong unpainted playthings which will bear rough treatment are the best. Children like to imitate their elders, and a needle and cotton with a small piece of flannel will amuse for a long time, if allowed only occasionally. A pencil and paper, or large glass beads to thread, are always a source of delight, and, a little later, some kindergarten toys should be provided. From a farmyard or Noah's ark, a child will soon be able to pick out the animals correctly. Celluloid toys should be avoided, as they are very dangerous, being highly inflammable. Picture books are a great delight; but until he can be taught to turn over the leaves carefully, they should always be shown by some one, or the child will become destructive. Pictures should always be of a pleasing character, and true to nature, for a child should never have to unlearn what it has once learnt. In teaching the name of objects, it is far better to give the true name at once, e. g., **horse**, not **gee-gee**; **dog**, not **bow-wow.** As the child gets a little older, it is confusing to know the same object by two different names.

A child should always be taught to put away one set of toys before bringing out another, and little tots of eighteen months will soon learn what **tidiness** means. The nursery should be a **happy** place; of course, every child likes to come downstairs to its parents, but, if the nurse be a good one, it will be just as ready to go back again.

Lessons.

A child for the first four or five years should learn simply by object lessons, and will thus lay the foundation for after study. Simple tales of natural history are always eagerly picked up, but to seriously begin lessons at too early an age is a mistake. All the Wesley family are stated to have been taught their alphabet on the day that they were five years old, but except as a change of amusement, nothing of this kind should ever be insisted on.

Infant schools are a great boon to mothers who are obliged to earn their living, but a good crèche or day nursery is far preferable, and no more expensive. At five or six, a kindergarten school may be thought of.

If a child be sent to school, it is useless to be always coddling it up and keeping it away for the slightest thing, but the constitutions of children vary, and a delicate one must be specially provided for. The following three classes of children require to be surrounded by specially favorable conditions during their school life:

(1). Children who are sickly and delicate.

(2). Children who have had a disease which, under unfavorable circumstances, will almost certainly recur, *e. g.*, scrofula.

(3). Children who, though healthy, are begotten of parents who have had diseases which are very apt to affect their offspring, e. g., consumption.

Moral Training.

Children's rules must be few in number, but what they are must always be enforced.

Obedience.—This will entail some struggles, but the child must be brought to see that the mother's or nurse's will is stronger than its own—then, and not before, will it give in. Always aim, however, to require the child to do **what is right** and to get him to recognize that it is **the right** and not merely the **mother's will** that is required. On this point, as indeed on every point, the mother and nurse must act as one; a child must not be allowed by one to do a certain thing which it is forbidden by the other.

The obedience must be that of love, not terror, and a little tact is here of great use. To tell a child not to do a thing is but to create the wish to do it; just human nature the wide world over. Do not be content with the **negative**, always suggest something **positive**; forbid a child to open a drawer and, at once, it will begin to be restless and fidget about, and at length will probably go up and open it. This is known in **psychology**, or the study of the mind, as **motor suggestion.** We are impelled to do what we are thinking about. Hence, if the prohibition be accompanied by a positive request, e. g., to fetch mother's thimble, the difficulty will be over; the desire to open the drawer will be forgotten, and will consequently vanish.

Direct disobedience should never be overlooked; but never as punishment deprive a child of its food, or shut it up in the dark. Taking away anything it is very fond of, e. g., a favorite doll or toy, will be

actually felt. Being made to sit quietly on a stool for ten minutes is another good method.

In very extreme cases, e. g., an act of direct spite or cruelty, a sound slap may be required, but should be administered only by the parent. **Never** box a child's ears. Parents, when obliged to punish, should always make the child feel how grieved they are to be forced to do so, and that it is not inflicted in the spirit of revenge. Favoritism should be carefully guarded against, always remembering that children have a very keen sense of justice.

A child often passes through a phase in which there is an extreme dislike to obeying the slightest command, even in the ordinary events of life, but it is as a rule only temporary. This occurs when **self-consciousness** appears—the recognition of self as an individual who can **will** and **do.**

Should he, for example, absolutely refuse to be dressed to go out, take no notice of the refusal, but while beginning to button his shoes talk of the little ducks he is going to feed in the park, or remind him of the game of hide and seek he loves, so that by a lively recollection of the past, or anticipation of the future, he will quite forget the objectionable present. Should these tactics, however, fail, it is of no use to lose one's temper. Give way pleasantly, saying, "Very well, if baby will not be dressed, of course he cannot go out, but he will have to stay all alone in the nursery," and there he must be resolutely left to realize the necessary consequence of his willfulness. A good fit of crying will probably result, but the lesson will be thoroughly learnt. This plan of **punishment of consequences** is always excellent. If a child abuses a toy he is to lose it. If he is tardy or not ready to go for a walk when the others are he must stay at home.

A mother should remember that when a child has lost his self-control it is useless to reason with him. He should be left absolutely alone till he is good, wholesome **neglect** being too little understood and practiced in many nurseries.

Truthfulness.—A child must at all times be encouraged to tell the truth. Never mind what he has done wrong, let the little one always find in his parent or nurse a friend to whom he can confess and tell everything. To punish a child when he comes to confess a fault, is but to set a premium on telling a lie. Let him clearly see your sorrow for the wrong deed, but do not punish. Many a child has been driven to tell a lie from fear of the consequences of telling the truth. A tiny child will say "yes" or "no" just as it feels inclined, not really

knowing the difference, but of course this is an entirely different thing to telling a lie. Moreover, children have vivid imaginations and may tell about things that are purely imaginary. This is not lying, but is really a sign of a valuable trait or faculty of the child's mind—that of **imagination.** **Make believe** is a good thing and to be cultivated intelligently and with discretion.

Loving Kindness.—This includes a great deal. It is necessary primarily in the parents and the nurse, and the example shown by them of uniform loving kindness, under the most trying circumstances, goes a long way in teaching it to the little ones. The elder should always share with the younger, but the younger ones must not have the best of everything.

Never allow a child to snatch from anyone; teach it to ask nicely for a thing, and if baby takes away an elder child's toy, the latter should be taught to give baby something in exchange for its own property.

Never allow a child to cherish a spirit of revenge. How often, if he falls down, is he told to "Whip the naughty floor or chair," as the case may be, or even allowed to vent his wrath upon some naughty person who displeases him. No; tell the child to "Kiss the place and make it well," or rub in a little eau de cologne, and he will be pleased and quite forget to be angry.

Of slight falls and knocks it is best to take no notice; too much sympathy engenders a fretful disposition, easily upset by trifles. Gentleness and loving kindness to all living creatures should be insisted upon.

There is a great difference between animal spirits and rowdiness. It shows a painful want of training for children always to rush into the sitting room, slam the door, and stamp on one's toes in their wild spirits. A lack of reverence is very noticeable in the youth of the present day, and respect for elders should be early enforced.

The nervous system of a child should receive a great deal of attention from quite early days. It is exceedingly sensitive, i. e., it responds instantly and intensely to any outside influence, and if stimulated unduly, many serious troubles may arise. For this reason a young child should not be constantly played with or talked to. When awake it should lie quietly in its cot or on a sofa, where it can watch people moving about, and outside impressions can be received slowly, as the nervous system can bear it. A precocious child is one to be dreaded, and to be kept especially quiet, and **never** have

its sayings or doings repeated in its presence, much less be encouraged to perform before admiring visitors.

A child should never be frightened, and stories of ghosts, bogies, fire, and robbers should be carefully refrained from and avoided. Ugly sights and discordant noises, e. g., Guy Fawkes and Punch and Judy shows, strongly affect some children, and should then be avoided for a time, gradually training the child to calmness and self control in the presence of strange sounds. In these children a sudden terror has produced fits, or St. Vitus' dance, or has caused a shock from which the child has never really recovered.

Night Terrors, where a child awakes crying with fright, often have their origin in **days** of excitement. Never hold up the doctor as an object of fear, it will create in the child's mind a spirit of distrust and a horror of all medicines.

Usefulness and Tidiness.—These are important items in a nursery education. All toys should be put away by the children themselves, and it is astonishing how tidy a child of two years old may become, even putting away things that its mother may have left about. A child delights to be made useful; to fetch and carry little things from one room to another, to fetch its father's slippers, or mother's gloves; to pretend to dust the furniture—all these things and many more go to make up a great deal of happiness for a child, and, at the same time, teach it many useful lessons.

It will thus be seen that moral training requires much wisdom. A spoilt child is a nuisance to itself and everyone else, and a lasting monument of disgrace to its guardians.

Sick Children.

A few words must be added on the subject of nursing sick children.

Children's hospitals are the places where the art of nursing the little ones is to be seen almost in perfection, and, in any very serious illness, if the parents be poor, the kindest thing is to take their children there. In many cases, if it can be afforded, a trained sick children's nurse will prove a great help, and, in some special cases, is almost indispensable.

It is in illness that a wise mother will reap the benefit of her careful training in good habits—sleeping, feeding, obedience, etc. It is not only good training, but in case of illness of great help to have a child accustomed to opening his mouth to allow the tongue and throat to be examined, to having a person's ear placed against

his thorax or chest to listen to the sounds of the heart and lungs, etc. In this way it is not only easier to examine a sick child, but the information gotten is more reliable because the child is not unduly excited when the procedure is already familiar. A sick child requires a great deal of "letting alone." The quieter it is kept in its cot, not dandled in the arms, the better. The struggles of a spoilt child over taking its medicine or food, have often gone a long way towards causing a fatal termination. In nursing sick children, there must be infinite patience, but invincible firmness; a vast amount of tact, but absolute truthfulness. If something nasty has to be swallowed, there should be no saying, "Now, darling, will you take something nice?" Once deceive a child, and it will never trust you again. Truth is essential; to say, "Now, darling, you must take this, it is not very nice, but will make you better, and you shall have a piece of chocolate after it," is far better policy, and will nearly always succeed with a child who has been brought up to obey.

Should the child refuse, do not worry and irritate it, but lift it gently out of bed, wrap a sheet several times around it, with the hands by the sides, gently hold its nose, and, when the mouth opens, put the spoon containing the medicine as far back as possible, keeping it there until the fluid be swallowed. This may, in some cases, apply to feeding. There must be no sign of anger or impatience on the nurse's part, but the operation should be performed just as a necessary consequence of the refusal on the child's part to take food or medicine. It will not often require repetition.

The strength of a child should be carefully husbanded. If ordered to bed it should be kept lying down, and, if really ill, other children must be excluded. Reading or relating little histories of everyday life are usually great charms to a child.

The nurse of a sick child cannot go on continually without being relieved, as one who is overwrought and tired out cannot be cheerful and patient. A competent person must take duty while the nurse has exercise or a night off duty.

In serious cases of illness it is always well to keep a chart, and note down every time the patient takes food, sleeps, has the bowels open, character of bowel movement, etc, for example:

6.00 a. m.	took 4 oz of milk.
8.00 a. m.	took 6 oz. of milk.
9.00 a. m.	Temperature, 103°; took medicine.
10.30 a. m.	6 oz. of beef tea; bowels open.

This acts as a guide to the doctor as well as to the nurse.

A sick child is soon up, and, when on the road to recovery, often traverses it with rapid steps. Convalescence is often a more trying time to the nurse than the illness itself. A new picture book, or some kindergarten work to employ the hands, is now called for; but, as a general rule, a child recovering from a severe illness will sleep a great deal more than when in health. This is one of nature's methods of renewing the waste to which the tissues have been subjected, and should be encouraged as much as possible.

The Sick Room should always have plenty of light (except in some cases of brain and eye disease) and fresh air. In fever cases, the room requires special treatment, elsewhere described.

INSTRUCTION THIRTY-NINE—*Minor Ailments*

Baby's Troubles and Ailments

Subject Reference.

See also Diseases of Children, pages 614-647.

TEETHING AND OTHER DIFFICULTIES.

Vaccination—Small-pox—Teething—Milk Teeth—Order of Teething—Disorders of Teething—Cleaning the Teeth—Permanent Teeth—Feverish Attacks—Temperature—Thermometer—Pulse—Respiration—Influenza Cold—Constipation—Thrush—The Navel—The Eyes—Incontinence of Urine—Prolapse of the Bowel—Cleft Palate—Hare Lip—Hernia—Ophthalmia.

It will now be well to consider some of the minor troubles which baby may, at one time or another, be called upon to endure; for an infant, however healthy, is subject to little ailments which every mother should be prepared for and know how to treat.

Vaccination.

The object of vaccination is to protect the child from small-pox. Many mothers have very strong objections to having their children vaccinated, which they base on the following grounds:

(1) It pains the child.

(2) It may introduce diseases, and even cause death.

(3) It is regarded by some as quite unnecessary, and practically of no value.

Now, the operation itself is **hardly painful at all,** especially if care be taken that the arm does not bleed (and properly it should not bleed), and the younger the child the less it is disturbed by the after effects. Some children "take" much more than others, and so suffer more

afterwards, but it is rare for a child to be upset for more than a day or two. As to the introduction of disease, this practically never happens now, and could only arise through great want of care. That it is valueless can not be maintained in the face of facts. Indeed, we now hardly know what small-pox is. The value of vaccination is amply demonstrated by the fact that, because efficiently vaccinated, no nurse or attendant in the small-pox hospitals ever takes the disease.

The following statistics are taken from a small-pox hospital:

Of every 100 persons admitted 35 per cent died who had never been vaccinated, 4 per cent died who had a vaccine scar, while only 1 per cent died who had a second vaccine scar.

Should vaccination ever be postponed? Certainly.

(1) If the child has a skin eruption, e. g., eczema.

(2) If the child be in a state of ill health.

(3) If the child has recently had an illness.

Vaccination is supposed to have been performed about three months after birth, and in any case should be well over before teething begins. It is, however, a very usual custom now to vaccinate babies at about a month old or even earlier. In some maternity hospitals the babies are vaccinated when a few days old—and with most happy results—the small patients appearing to take no notice whatever of the proceeding, and as they move about less at an early age, there is less irritation.

It is necessary to vaccinate in one place only, high up on the arm, but not on the point of the shoulder. If the operation be successful, a small red pimple will be observed on the third or fourth day; on the fifth day the red pimple turns into a spot, with a watery head. This spot slowly enlarges, and the skin around it becomes red, hot, and tender. About the tenth day the place may burst and discharge, but this is due to an accidental rub or knock and is not fortunate, while the center begins to dry up into a black scab, which falls off on about the twentieth day, leaving a depressed scar. An arm that is not practically well by three weeks should have medical attention.

The child usually suffers most from about the eighth to the eleventh day, and may be slightly feverish, off its food, and restless, The amount of pain, however, varies very much, many children not suffering at all.

It is of importance that the place be not subjected to friction, or violence of any kind, otherwise the spot will get broken, or have the

top knocked off before the proper time. Many mothers use vaccination shields, but they are usually most inefficient, and apt to get out of place, thus creating the very evils they are meant to avert. A pad of antiseptic gauze may be fastened on about the eighth day, and be left undisturbed. Some doctors paint the sites of inoculation as soon as dry with some impervious solution, e. g., zinc gelatine, which forms a protective covering, and enables the child to have its bath as usual.

Erysipelas is a rare complication of vaccination, and is always due to a want of cleanliness, either at the time of the inoculation or later, or the germs may be present in the vaccine unless this be from a reliable and well-known manufacturer. It is no uncommon thing for a rash to appear within a few days, but it is only of a temporary nature.

Does it matter in how many places a child is vaccinated? No. One mark protects as well as two or three. Two or three good marks are quite satisfactory if due to vaccinations at different times and if each is due to a true vaccination.

Will one vaccination protect an individual for a lifetime? As time goes on, the effect passes off, and it is better to be revaccinated at ten and again at twenty-five. In Germany, where compulsory vaccination and re-vaccination are thoroughly enforced, small-pox is practically unknown.

In an epidemic or in case of exposure to a case of small-pox vaccination should be done at once.

Teething.

The date at which the first tooth appears is very variable. Children have been born with teeth, while, on the other hand, the first may not appear until the child is more than a year old.

An acute illness will delay teething, but the chief cause of late dentition is rickets.

The order in which the teeth should be cut is as follows:

About the seventh month the two middle teeth in the lower jaw. A few weeks later the two middle teeth in the upper jaw; these four are the central incisors.

At eight months the lateral incisors, top and bottom.

At twelve months the four (i. e., one at each end of the dental arches or rows of teeth) back teeth or molars.

At sixteen months the four eye teeth.

At twenty-four to thirty-five months the other four molars.

The above constitute the **temporary** or **milk teeth.** If not cut in the right order baby is said to cut its teeth "cross."

Most healthy children cut their teeth with very little trouble, indeed, the teeth are often through before the mother is aware that anything is going on.

When teething the gum becomes swollen and hot, and the child will dribble or drule a great deal and put its fingers in its mouth. Here it might be mentioned that without care this constant dribbling

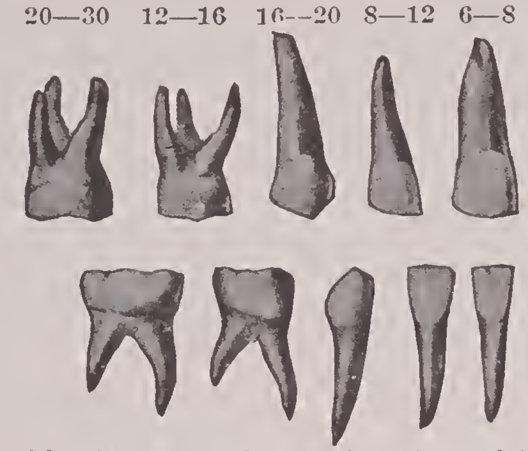


Fig. 234. The right half of the set of milk teeth. The numbers give the age (in months) at which the teeth "erupt" or are cut.

may be a source of danger, through the child's clothes becoming saturated, the consequent chilliness producing bronchitis. A jaconet bib should be worn beneath the ordinary one—jaconet being a thin cloth faced on one side with mackintosh. Beneath the gum can often be seen the white line of the coming teeth.

Some children cut their teeth with difficulty, getting an attack of eczema, bronchitis, or diarrhœa with each tooth. The eye teeth often cause more trouble than any of the others.

While teething a child should be specially guarded against catching cold.

If the tooth seems nearly through, the gum may be gently rubbed with the end of a thimble or an ivory ring or a **clean** sharp-pointed knife may be used to lance the gum.

Sometimes, when cutting a tooth, the child will get very fractious and restless, waking up many times during the night, starting and screaming. A little bromide is often very useful in these cases. A warm bath, also, given as follows, is often most soothing:

Put water of temperature 105° into a bath of sufficient depth to reach to the child's waist when sitting down. Place a board or sheet

over the bath for the child's toys, and keep it in five minutes, not allowing the hands or any part above the waist to be wetted. A little shawl should be fastened around the upper part to prevent chill. When taken out the lower part of the child will be of a scarlet color, and it should be well rubbed and put to bed.

Convulsions during teething are not very common. A hot bath and a dose of castor oil is the best treatment, and the tooth may need lancing. It is a pity to lance a tooth too early, as the point will then have difficulty in piercing through the scar. A slight diarrhœa may act as a safety valve during teething, but it should never be allowed to become at all severe, or it will quickly weaken the child. The diet should be light and restricted, as the stomach is easily upset during teething.

How soon should a child's teeth be cleaned? As soon as it has any. The mouth-washing with the finger wrapped in linen having been regularly carried out twice a day from birth, a soft tooth brush can be substituted as soon as the eight incisors are cut. A little good soap may be used occasionally.

It is a great mistake not to carefully look after the milk teeth, as upon their welfare depends, at any rate to some degree, the welfare of the permanent set.

The Permanent Teeth should be cut in the following order:

Seventh year, four first molars or grinders (not present in the milk set).

Eighth year, four central incisors; ninth year, four lateral incisors; tenth year, four first bicuspids; eleventh year, four second bicuspids: twelfth year, four canine or eye teeth; thirteenth year, four second molars. (Replacing the milk teeth. These are lost by the **absorption** of their roots.)

Seventeenth to twenty-fifth year, four third molars or wisdom teeth. (Not present in the milk set.)

The temporary set consists of twenty teeth, the permanent set of thirty-two.

If a tooth be at all decayed the child should be taken at once to a dentist, as it should be "stopped" or "filled" before it begins to ache. It is a very common thing for teeth to be too near together, or too far apart. A dentist should always be consulted in such cases.

Feverish Attacks.

Nearly all babies at times are subject to these. The nervous system of a baby is very delicate, and what would not in the least

affect an adult may, in an infant, produce a bad feverish attack. In some instances the cause is easy enough to detect; the child is cutting a tooth, has caught a cold, etc.; but very often the cause is so slight as to escape detection; no doubt there is one, but what it is is unknown.

The signs of a feverish attack are as follows: The child is off its food, is restless and irritable, the skin is dry and hot, especially the head, which often feels burning, the breath is short and quick, and usually heavy, and the pulse beats very fast.

The child should be kept quiet and away from other children, as it is very sensitive to noise, and will probably start at the least sound.

If the bowels be confined, a teaspoonful of castor oil may be given; and if exhausted or restless the child may have, according to age, twenty, thirty, or forty drops of brandy in a tablespoonful of water, which will often have the effect of soothing and getting it off to sleep.

If the child seems ill give it a hot bath, as described under teething, and put it to bed.

It is of no use to press it with food, as this will only induce vomiting. For the thirst, milk and water, or barley-water, may be given. It is astonishing how quickly a child will "take a turn;" one hour it may be lying exhausted, with hot, flushed cheeks and a burning skin, panting and tossing to and fro in its restlessness, while the next it may be calmly dozing with a cool, moist skin, and sucking its thumb in contentment.

Yet remember that almost all illnesses begin with more or less fever, and what at first may have been taken as "only one of baby's feverish attacks" may afterwards turn out to be the beginning of a long and serious illness.

Temperature.—The amount of fever can easily be ascertained by means of a clinical thermometer. Every mother of a family should possess one, and know how to use it. This instrument is exactly on the same principle as an ordinary nursery or bath thermometer, but on a smaller scale, and contains an index, the top of which marks the highest point to which the mercury has risen. The natural body heat is 98½ degrees F. This mark on the scale of the thermometer is usually noted by an arrow. The way to take the temperature of a child is as follows:

Shake down the index of the thermometer until it is below the arrow mark, then draw the arm away from the side and put the bulb

of the thermometer well up into the armpit, then hold the arm close against the side of the chest for five minutes; on removal the top of the index will mark the temperature. It is sometimes more convenient to take the temperature in the fold of the groin; the thigh should in this case be bent up so as to bury the instrument in its crease. Care must be taken that no article of clothing intervenes between the skin and the thermometer, and that the instrument does not shift from its proper position. Taken in either of these ways the temperature is about a degree lower than that in the body. Sometimes the temperature is taken by introducing the bulb of the thermometer into the rectum or lower part of the bowel; the reading will then be about a degree higher than that taken on the surface of the body. The price of a good clinical thermometer is about one dollar.

A slight cold will often send the temperature of a child up to 102° or 103°. In bronchitis it often rises to 103° or 104°. But temperature in children has not the same importance that it has in adults. A child may be 104° and then in a few hours be only 100°, though persistent high temperature indicates disease.

Pulse and Respiration.—Both of these usually have a certain relation to the temperature, i. e., if the temperature goes up, the pulse and respirations will increase in number, and **vice versa.**

In sleep it is by far the best; indeed, it is the only reliable time to count the pulse and breathing, both of which are at a much higher rate than in an adult. At birth the pulse rate is about 150 to the minute. During the first year it keeps above 100; during the second and third years it keeps at 100, or rather under; during the fourth year 90, and during the fifth 80. These numbers are only approximate and different children may vary somewhat from them.

The Pulse of a child can easily be counted, as in the adult, by feeling the number of beats of the artery which is at the front of the wrist, about two inches above the root of the thumb. For a young child another convenient way is to watch or feel the beating of the pulse in the brain at the anterior fontanelle, or hole in the skull. The fontanelle gradually lessens in size, and should be quite filled in by about two years old.

The normal breathing of an infant a month old is about forty to the minute; at two years old, thirty, and at eight years old, about twenty. The least thing will send up either the rate of breathing or the pulse at once, but no amount of restlessness or excitement will raise the temperature much above the normal. An increase in temperature always means fever.

Influenza Cold.

Infants are very liable to contract heavy colds; their skins are so sensitive and their whole being so delicately constituted, that they are very susceptible to changes of temperature. The delicate mucous membrane of a child is specially apt to allow a cold to spread, e. g., a cold in the nose or throat is far more likely to spread down the bronchial tubes to the lungs in the case of an infant than in an adult.

Anything that lowers a child's vitality, renders it more liable to catch cold. A child's vitality may be lowered by insufficient food and warmth, but the most frequent cause is **bad air,** i. e., air which has been breathed over and over again. On a wet or damp day, perhaps, several children are kept shut up in a nursery all day long with the windows and doors closed. Of course, in a few hours, all the pure air will have been used up, and then they will be breathing over and over again the same air, charged with noxious gases. The following day being fine, but damp, the children are sent out of doors, and catch cold. If they had been turned out of the nursery for half an hour two or three times the day before, and the room thoroughly aired, they would probably have escaped.

Another frequent cause of colds arises from a false idea as to "hardening." While a child has very little hair, the skin of the head is just as delicate as the skin elsewhere, and must therefore be protected from draughts. In a room airy but not draughty, no covering is required, but if taken across a landing, with windows open on all sides, as is quite right, a little woolen shawl should be thrown over the head. When nature has provided a covering of hair, no wrap is required.

A child properly clothed will take no harm in passing through draughts, but to remain stationary in a direct draught will probably bring on a cold. The rule to be observed is plenty of fresh air, but no draughts. Acute nasal catarrh being very infectious, a baby should not be kissed or nursed by anyone suffering from this disorder, nor indeed from any illness.

A baby's cold usually begins with a running of the nose by day, while at night the upper part of the nose is apt to get stopped up with mucus, which prevents the passage of air through the nostrils and causes it to sleep with its mouth open. A bad cold interferes with sucking, which is very noticeable when the child takes its food, and poor baby cannot suck his thumb when going to sleep. He may at the same time be feverish, restless, and have little appetite.

If the weather be cold he must be kept strictly indoors, and at an even temperature of 62° to 64°. The room should be well ventilated and not allowed to get stuffy, nor the air to become dry. It is well to steam the room. On fine days, in summer, the child may be allowed to go out if the outside temperature be 64°. Diet will require little, if any, alteration; over-feeding is certainly not to be tried. The bowels should be opened once a day, but no strong purgatives should be used. The stuffiness of the nose may be greatly diminished by gently inserting into the nostrils a new camel's hair brush with a little sweet oil, or, better still, some vaseline with eucalyptus oil, half a dram of the oil to an ounce of the vaseline. Pure vaseline is all that is usually required. Put it in the nose, also across the root of the nose and the lower part of the forehead and give a quarter of a teaspoonful or more internally. Renew the application when it has dried in. Grease may also be well rubbed in over the root of the nose. The bath at 105° in front of a fire, the child being entirely under water with the exception of its head, will often help to get rid of a cold. It should be lifted out of the bath into a warm blanket, rubbed dry without being uncovered, and put quickly into a warmed bed.

Constipation.

This is a trouble to which hand-fed babies are much more liable than breast-fed ones. Should it occur in the latter, there is generally an insufficiency of fatty matter in the mother's milk, and she should drink more rich milk or cream, and may with advantage take oatmeal porridge, and stewed fruit. In hand-fed babies a lack of fat in their food is the most usual cause. This may arise from the child's food being too weak, or insufficient in quantity, and should be corrected by the tables on diet. Should it persist, more cream or some Mellin's food added to each bottle, a little salad oil or cod-liver oil given twice a day, half a teaspoonful of manna, or the juice of stewed prunes, may any one of them prove effectual. Some doctors recommend a little phosphate of soda in each bottle, and if barley-water be used with the milk, oatmeal-water may be substituted. Rubbing the abdomen with sweet oil (which is simply massage) is always helpful and may be all that is needed.

Constant drugging for simple constipation is bad. Some children **habitually** go two days without an action of the bowels, and are none the worse for it. First try one of the simple remedies, after which, if useless, it may be well to use an enema of two ounces of soapy water

with a dessert-spoonful of olive oil. A small piece of soap passed into the lower bowel will often suffice in infants. Some doctors recommend an injection of a teaspoonful of glycerine, or a glycerine suppository, which often answers very well. Over a year old, a baked apple without the skin, or a little stewed fruit, with coarse, moist sugar, will effect what is required. The habit should be early formed of making a child "go" at a certain fixed hour every day. For example, every day directly after breakfast the child should be placed in its chair; it should not, however, be left there more than five or ten minutes, as long-continued straining is apt to cause prolapse of the bowel.

Cod-liver oil every morning is often very successful; and friction and kneading over the whole of the bowels not only help to strengthen the muscles, but often greatly assist in regulating them. In some children constipation can easily be corrected by means of a compress. A handkerchief, wrung out of warm water, is folded into an oblong of about twelve by four inches, and placed over the child's belly. A piece of oiled silk or pink jaconet, just big enough to overlap it in all directions, is placed over, and the whole kept in place by a turn or two of bandage. The compress should be put on when the child goes to bed, and kept on all night.

If a child strain much, and pass only a little slime and blood, a doctor should be sent for **at once**, as the case may prove a serious one.

Thrush, or Sprue.

This is a sign that the child is out of health, and is nearly always due to a want of cleanliness. It appears as little flakes or patches of white on the lips and inside of the cheeks. It may even cover the tongue and whole insides of the cheeks. It looks like milk curds, but when rubbed off leaves a red spot which may bleed a little. Hand-fed babies are far more likely to be attacked than those brought up at the breast. Sour milk, dirty bottles, and stuffy nurseries are all likely causes of thrush, which, as is only to be expected, is more prevalent in hot weather.

For thrush to appear, the mucous membrane must be in an unhealthy state. The great **preventive** is **cleanliness**, i. e., clean bottles and teats, freshly prepared food, plenty of fresh air, and frequent washing of the mouth.

In a case of thrush, three grain doses of bicarbonate of soda may be given, twice a day, to counteract the acidity, for a child four

months old. A dose of castor oil may be given to start with, and the mouth swabbed out with a piece of soft rag, dipped in a solution of boracic acid, after each meal, a fresh piece of rag being used each time. Lastly, the patches should be painted with glycerine and borax four or five times during the day. If suitable weather the child should go out.

The Navel, or Umbilicus.

The cord or navel-string generally falls off about the fifth day. Usually there is no trouble with it, especially if it have been dressed carefully at the beginning; but sometimes a sore, with proud flesh, is left, which is difficult to heal.

A distinct weakness is in some cases left at the navel, and whenever the child coughs or cries there is a bulging, and a small swelling appears. The treatment for this is pressure. This is best applied by carefully making a pad, and after pushing back the swelling, fixing it over the place with adhesive strapping, and then applying the ordinary binder. It is well to place something hard in the center of the pad, e. g., a slice of cork. The pad thus applied should not be removed for some days, and then only for a fresh one to be put on. In cases of large protrusions a proper surgical appliance will probably be required. Usually the protuberance disappears in two or three weeks.

The Eyes.

The eyes of an infant are very subject to inflammation, and require a good deal of attention. Neglect at birth, cold, or the access of soap into them may, any one of them, set up inflammation. Any discharge must be carefully removed whenever it forms. **See page 640.**

Snoring.

This bad habit is usually the result of defective training in early life. It is of the greatest importance to educate an infant to breathe habitually through its nose, and not through its mouth. The air, in passing through the nasal cavities, is warmed and moistened before reaching the lungs—a simple preventive of colds.

Whenever a child's mouth is seen to be open, unless indeed it be crying or feeding, it should be gently closed, and especially is this necessary when laying an infant down in its cradle for a sleep. If

this be neglected the throat becomes dry and rough, and the tonsils may eventually become enlarged, and snoring will probably result.

In some cases a child is unable to breathe through its nose, and always has its mouth open; there is then an obstruction to the free passage of air, due either to enlarged tonsils, or polypoid growths, known as adenoids, at the back of the nose. The child should be taken to a surgeon, who will effect a cure. Neglect of this condition leads to very serious consequences, such as deafness, lung-trouble, stupidity, etc.

Incontinence of Urine (Enuresis).

Some children suffer from wetting their bed even up to the age of four or five years. Some are simply cases of bad habit and neglect, but very often the child is not to blame at all. Many a one has been punished for what was no fault of its own. The first thing to do is to have the child examined by a doctor to see that nothing is wrong, such as adherent foreskin, as, in many cases, a slight operation will set all right at once.

If the patient be assured upon this point, patient management, assisted by suitable medicine, will almost certainly succeed. Never allow the child to sleep on its back, and, if necessary, prevent it doing so by tying a spool in position over the middle of the spine. Always put the child on the chamber the last thing at night, if possible once during the night, and the first thing in the morning. Do not give much liquids after 4 o'clock p. m.

Rupture.

Hernia is not uncommon even in very young infants. A rupture consists of a protrusion of a portion of the intestine which has been forced through the abdominal wall, and can be felt as a lump under the skin. The groin is the most common place for a rupture, although one may appear near the navel.

When the child cries, the rupture will swell up and get larger, whilst on the other hand, if the child keeps quiet and stops crying it will become smaller and perhaps quite disappear. If the bowel should come down and get nipped in the opening through which it escapes from the abdomen, the child will be in imminent danger. The bowel has become what is called "strangulated;" nothing can pass through it, and unless relieved it will mortify. When a hernia is strangulated it will not go back into the abdomen, vomiting is quickly

set up, there is constipation, and fatal collapse will soon set in if nothing be done to afford relief.

If an infant who is known to have a rupture be suddenly seized with vomiting and constipation, send for a doctor **at once**; never mind whether the rupture appear down or not, appearances are often deceptive. The doctor will frequently be able to remedy the trouble without an operation. The longer a strangulated rupture is allowed to remain unrelieved, the greater the danger to the child. Never, under any circumstances, should a mother be tempted to try and press back the strangulated rupture herself.

No child is too young to wear a truss; directly a rupture is discovered a truss should be worn. If it be allowed to grow up without one, not only will the rupture continually grow larger, but there will always be the danger of its becoming strangulated.

The truss should be worn day and night, and the parent should always be provided with two in case of an accident. Trusses should never be bought except at proper surgical instrument shops; an unsuitable appliance not only does no good, but a great deal of harm. For young children they are made covered with india-rubber, to prevent soiling, and enabling them to be washed. If the truss be taken off for any purpose the mother should always support the hole through which the rupture comes with the hand, else during a sudden movement or cry of the child it may descend.

The skin in the neighborhood of the truss must be kept scrupulously clean and dry, and be dusted with starch powder, or chafing will ensue. The truss should be considered as an article of clothing, and will then never be overlooked.

If the wearing of a truss be persevered in from birth, it will probably effect a permanent cure, and at the end of about two years may safely be discarded. The great point with children is **never** to allow the rupture to come down; its descent, even once, will undo all the good the past six months' treatment may have effected. If a rupture persists after this age, take the child to a surgeon, who will probably advise an operation for its radical cure.

Prolapse of the Bowel.

This is usually produced by great straining, e. g., in diarrhea or constipation. In this affection the lower part of the bowel comes down after straining, and protrudes from the orifice as a violet-colored mass. The great treatment is to regulate the bowels. As a

rule the prolapse only occurs when the bowels act, and goes back of itself; if it should not do so, wash carefully, apply some vaseline, and use gentle pressure, the child lying on its stomach. If a child be subject to prolapse, the orifice should be supported by pressing the buttocks together whilst the bowels are acting, and he should never be allowed to sit long upon the vessel for fear of straining. In some cases an operation is necessary. Always after the bowels have moved pressure should be made on the anus with a soft pad of folded or crumpled toilet paper. This returns the parts to their normal position and removes the congestion of the blood-vessels which may lead to hemorrhoids or to prolapse.

Congenital Defects.

Harelip is a congenital defect, consisting of a split through one or both sides of the upper lip, usually extending into the nose. The child is generally operated on early in life.

Cleft Palate, which is often associated with harelip, consists of a split or division in the palate, so that the nose and mouth form one cavity, i. e., the floor of the nose is in part absent.

A child with cleft palate has usually great difficulty in taking its food, because as fast as the milk is taken in through the mouth it returns by the nose. The child cannot create the vacuum in its mouth necessary for sucking, and so is unable to be brought up at the breast. It should be seated bolt upright when being fed, and an old-fashioned boat bottle, with a long teat made for the purpose, employed, so that the flow of milk can be regulated by the inclination of the bottle, and no sucking be required. Of course, the mother's milk can be given after it has been drawn off by the breast pump.

Unless great care and perseverance be used, such a child will not get enough food, and will pine away. Operation to repair the defect in the palate is necessary and must be done as soon as possible.

Tongue Tie is usually a very minor affair, caused by the tightness of the fold of the mucous membrane which binds down the tongue to the floor of the mouth. The child is unable to protrude its tongue properly, and cannot suck freely. The doctor will very soon rectify it.

Club Foot is a permanent turning of the foot in a wrong direction, so that when older, the child will walk on the inside or outside of the foot, instead of on the sole; the heel is usually drawn up at the same time. Pliable metal splints, carefully applied, will usually effect a cure. Manipulation, i. e., holding the foot in position, combined with

rubbing the muscles of the leg and foot, is very useful, and should be employed whenever the splints are removed. It may effect a complete cure without the use of splints or any mechanical appliance. It should be begun as soon as the deformity is recognized and be patiently persisted in. The treatment should never be discontinued until the foot is quite well. It is always a great trial of patience, but the parent will never regret the trouble taken.

No child is too young to undergo treatment, indeed, the younger the better. As soon as he begins to walk he will probably require a light iron in the boot for a short time, to prevent the foot returning to its old distorted position. In a few months, however, the iron may probably be discarded. These "irons" are now usually made of steel, and are far lighter and in every way better than the old-fashioned ones. In some cases the tendons of the foot may be so tight and contracted that it becomes impossible to get the limb into a proper position without dividing them. This is a very trivial operation, and the little puncture made heals up in a day or two.

The great requisite for treating club-foot is patience. It is of no use to be in a hurry, and the parent must remember that any bandage, splint, or apparatus, is not to force, but to gradually draw the foot into its right position. A strap or bandage put on too tightly will cause redness of the skin, and, later on, a sore, that may cause treatment to be discontinued some days, and this waste of time has all arisen through being in too great a hurry.

The skin of an infant is exceedingly delicate, and every time the apparatus is changed the limb should be carefully washed, dried, then bathed with a little spirit lotion, and well dusted with starch powder.

Heart Disease is usually evidenced by the dark blue color of the child. A baby may, however, be of a bluish color for a few days after birth, and then gradually assume a healthy rosy hue, and there may be nothing wrong at all. But if, after a few days, the child still remain blue, a malformation of the heart must be suspected.

Children with congenital heart disease are difficult to rear, any little cold or bronchitis, which in a healthy child would be of no consequence, being of grave import to them, as it gives the heart extra work. In bad cases the skin is of a dark blue color, and the child pants for breath after the least exertion. Severe cases very rarely live to grow up.

Accidents That May Happen to Children

THE MOTHER SHOULD KNOW THE RIGHT THING TO DO IN EMERGENCIES

Accidents—Burns—Scalds—Scorches — Bruises — Concussion—Cuts—Sprains—Dislocations—Fractures—Suffocation—Swallowing Foreign Substances — Choking — Foreign Substances in Ears or Nose—Poisoning—Dog-Bites.

Many accidents are due to sheer carelessness and neglect on the part of the "grown-ups;" still it is a true saying that "Accidents may happen in the best regulated families," and the mother should know what is the right thing to be done in an emergency, and do it at once. It is almost as important to know what should **not** be done, as what to do, for many a trivial accident has been converted into a very serious one by misdirected zeal on the mother's part. The slightest doubt as to what ought to be done is a clear indication that a doctor should be sent for.

Burns and Scalds are very common among children, especially among the poorer class; about 3,000 lives are lost every year from these causes in England alone. Such accidents often happen through a lighted lamp or a vessel containing hot fluid being upset. Should a child's clothes catch fire, **smother the flames with anything handy**; your own dress if nothing better offers. **Never wait** and call for help, and **never carry the child** elsewhere, till every particle of flame has been extinguished.

Scalds and burns produce an alarming amount of shock and prostration, especially if the surface involved be large. They are far more dangerous on the trunk than on the limbs. The bigger a burn or scald, even though it be one of slight degree, the more dangerous it is. Whilst waiting for a doctor, cover up the affected parts with soft rags, dipped in sweet oil, and give the child some brandy.

In the case of slight scalds or scorches, a mixture of equal parts of collodion and castor oil, well mixed together, and applied with a soft paint brush, will allay the pain at once. A solution of carbonate of

soda, made as strong as possible, and applied with soft rags, will also quickly give relief.

The course that a bad burn takes may be divided into three stages —(1) **Shock:** this usually lasts one or two days, and is followed by (2) **Inflammation,** which will last about ten days, and be concluded by (3) the stage of **Exhaustion.** During any of these three stages the child may die. Burns and scalds on the chest are peculiarly fatal in young children, as the period of shock is very marked, and inflammation of the lungs is very apt to set in.

If the part be only scorched, fine flour or whitening may be dusted on and covered with cotton wool. If, however, the skin be really burnt, an oily or greasy application will be the best. An ointment of vaseline and eucalyptus oil, or one of boracic acid and lard, spread on strips of lint or linen, should be applied to the affected part, covered by a layer of cotton wool, and kept in position by light bandages. Carron oil, which consists of equal parts of olive oil and lime water, is a favorite remedy, but unless it be frequently changed, the odor will not be very agreeable. At first a burn or scald, unless a slight one, will require dressing every day. All should be got ready and the lint spread, before the part be uncovered, so that the wound may be exposed to the air as little as possible. In using lint, the smooth, and not the rough side, should be placed next the skin, or it will stick to the wound and cause needless pain. Blisters require opening about the second or third day. The less often a burn has to be dressed, the quicker it will get well, but then it **must** be kept clean. To know when to dress a burn, and when to let it alone, requires experience.

After the first few days, when changing the dressing, the wound may be cleansed with a little Condy's fluid in warm water. Do not dab the wound, but gently squeeze a sponge full of the lotion and held just over, so that a stream trickles over the part.

The pain of a burn is very great, and the dressings will be a great trial to the mother; but the more that antiseptics are employed, the less will be the smell, and the less often will the wound require touching. The antiseptics usually employed are preparations of eucalyptus and sanitas oils, boracic acid, and iodoform.

The general health of the child will require looking after, and convalescence is always very slow.

Burns and scalds always look their best soon after their infliction, and what appears trivial at first is apt about the fourth or fifth day to look more serious. If the skin be burnt through its entire thickness,

a scar must ensue; if the whole depth of the skin be not destroyed, there will be no scar. Deep burns, even though small in extent, tend, when healing, to contract and produce deformity, splints being often necessary to prevent this, or it may be necessary to resort to a surgical operation later.

Bruises, Cuts, and Sprains.

Bruises.—A mother is sometimes unnecessarily alarmed by the sight of a lump on her new-born baby's head. It has formed from pressure during birth, and will probably get all right in a few days. The same cause may in some cases produce paralysis of one side of the face, which will almost certainly pass off after a time.

A child, when beginning to walk, is sure to get a good many tumbles, and probably not a few bruises. A common place for a bruise is the forehead, caused, usually, by the child coming down on something hard, e. g., the corner of a sofa or chair. A tender swelling appears, gradually increasing in size; later on it turns blue, then green and yellow, and finally disappears. If the child seem in pain, put on a little spirit lotion of Eau de Cologne, and a plentiful supply of grease helps to lessen the discoloration. A piece of raw beef applied at once, and changed every hour, is said to cause a bruise to disappear very rapidly.

Concussion.—The skull of a child is very thin, as before stated, and a severe blow on the head should never be lightly regarded. Even though there be no wound or bruise externally, yet the brain may have sustained a shock of concussion. In severe concussion, the child is rendered quite insensible, the breathing is short and quick, and the skin cold. As the effects pass off, the child gets warmer, gradually regains consciousness, and is probably sick. In unfavorable cases, inflammation of the brain may set in, the vomiting may persist, and the case terminate fatally.

In a case of concussion, even if slight, put the child to bed, darken the room, and keep everything quiet. Feed the child very lightly, and, if necessary, give a little castor oil. Quiet and sleep are what the child wants. It is impossible to predict with certainty how such a case may terminate, and a doctor should always be called in.

Cuts.—Children often wound themselves with knives, scissors, etc.; as a rule, a small piece of lint applied to the wound, and kept on until it heals, will set all right. In the case of deeper wounds, where the bleeding will not stop, put on a piece of lint, and bind up firmly

with a long strip of rag, used as a bandage, and the bleeding will probably not recur. But the bandage should be loosened in a few hours, or the part may mortify from the pressure employed.

Sprains usually occur from carelessly lifting a child, or from rough play. The joint may be twisted or strained, becoming swollen and painful. With rest and warm compresses or evaporating lotion it usually soon recovers.

Dislocations and Fractures.

Dislocations are rare in childhood, and, in such cases, there is always deformity of the joint present. While waiting for the doctor, immerse or bathe the joint in very hot water.

It is not a very uncommon thing for a child to be born with one, or even both hips out of joint. The mother may not detect anything wrong with the child at first, but when walking should begin, something unusual is generally noticed. If the dislocation be single, the one leg will be shorter than the other; if double, the child will waddle like a duck. Some improvement or often a cure can be effected by operation, and appropriate boots or instruments will help to a great extent.

Fractures.—The commonest fractures which happen to infants are those of the thigh, arm, and collar bones. If the bone be completely broken through, the evidences of the break are generally pretty clear. The child screams with pain on the slightest attempt to move the part, and the broken ends of the bone stick up, forming a lump. Very often, however, the bone is not broken quite through, but is partly bent and partly broken and splintered, producing what is called a "green stick" fracture.

"Green Stick" Fracture is very common in children, because their bones contain a large amount of fibrous tissue in proportion to the earthy matter, and are thus able to bend without snapping. Fractures in infants generally do very well, if the parts be put up in a suitable apparatus and kept at rest. New bone is formed out between and round the two ends. This forms a lump, termed a **callus,** which will gradually disappear as the new bone hardens.

Suffocation.

This accident is not so rare as many think, and usually arises from the mother taking the child to bed with her. It is a common enough thing for a mother to drop off to sleep whilst baby is still at the

breast—how probable, then, that she should turn over on the child, and thus suffocate it. There can hardly be anything more heart-rending than the feelings of a mother who, on waking, finds her infant dead by her side.

The accident may happen in another way. The infant may be snugly wrapped up in a shawl, and, whilst asleep, partially turn over, burying its face in the wrap; not having the power to turn back again, it is suffocated.

In cases of sudden spasm of the air passage, the child may literally die for want of breath, but this is not frequent.

Swallowing Foreign Substances.

At a certain stage, everything that a child can get hold of it puts into its mouth, so that it is a common thing for a child to swallow buttons, coins, small toys, etc. If the substance swallowed be large, e. g., a crust of bread, it will stick in the throat, and the child will get red in the face, its eyes will fill with tears and it will put up its hands to its mouth, and try to cough. The mother should at once put her finger down the child's throat and try to hook out the offender. If this do not succeed, and the child seem on the verge of suffocation, catch hold of it by its feet and hold it with its head downwards, and give it a smart smack on the back. It is sometimes successful to support the child against the side of your thigh as you sit and then give him a smart slap with your hand on his back, between the shoulders. This drives the air suddenly and forcibly out of the lungs and carries out any obstructing body in the larynx or pharynx.

If a foreign body be swallowed, and get safely into the stomach, the best thing is to do—nothing. Do not make the child sick; and, above all, **do not give castor oil or any purgative medicine;** the offending body will be passed in due time without any further trouble. In older children porridge, potatoes, and bread and milk form the best diet, so that a mass may result, in the midst of which the substance may subsequently be passed without any injury to the intestine. By giving purgatives the delicate mucous membrane of the stomach and bowels will be irritated by the hard offending substance being rapidly forced along against it.

Foreign Bodies in the Ear.

Small bodies, e. g., peas, beads, or buttons, are often pushed into a child's ear or nose. If the substance be far in, never attempt to

extract it; the child will almost certainly struggle, and serious results may ensue. Take the child at once to a doctor, who will, if necessary, put it under chloroform and extract the article without any risk or damage. A foreign substance left in the ear will produce permanent deafness. Ill-advised, bungling attempts to dislodge the offender may set up fatal inflammation of the brain. Snuff, to cause sneezing, is sometimes useful to dislodge foreign bodies in the nose.

Poisoning.

This is not a common accident in childhood. Many toys, however, especially those covered with red, green, or white paint, are poisonous if sucked. Lucifer matches are poisonous from the phosphorus they contain. Should a case occur, make the child vomit and send for a doctor.

A chronic form of arsenic poisoning may occur from the wall paper of the room containing arsenic, and a form of lead poisoning, from water impregnated with that metal. In both cases there are intestinal disturbances.

Bites or Scratches.

These may occur either by dog or cat, and are apt to cause unnecessary alarm. Should the animal appear to be in its usual health, and have snapped because teased or trodden on, no fear need be felt. The wound should be thoroughly washed with carbolic acid lotion, one part in forty, and dressed with a piece of lint soaked in the same and covered with a piece of gutta-percha tissue.

On the other hand, should the animal have been morose and off its food for a few days, it should be confined for a few days and carefully fed and observed to see if it die of hydrophobia. If it be killed its body should (or at least the **head** packed in ice or otherwise kept cool) be sent to the authorities, who will examine it, and in a few days inform the sender whether it had rabies, i. e., hydrophobia. Should this be suspected, or the dog be a stray one, the bite should immediately after infliction be strongly sucked, then thoroughly cleaned with a strong solution of carbolic (one part in twenty) or strong iodine solution, and the child be at once taken to a doctor. The immediate sucking to prevent the poison getting into the circulation is most important. If it be proved that the animal had rabies, the doctor will probably recommend Pasteur treatment.

Subject Reference.

For Medicines for Infants and Children, see Vol. 1, pages 647-655.

For Rickets, also see Vol. 1, page 329 and Vol. 2, pages 127-128.

For Deformities, see Vol. 2, pages 140-142. For Croup, see pages 376 to 381.

Diseases of Children

With General Instructions to Mothers with Infants.

Bronchitis—Inflammation of the Lungs—Pleurisy—Fever—Baths—Wet Pack—Chicken-pox—Measles—German Measles—Scarlet Fever—Small-pox—Typhoid Fever—Whooping Cough—Diphtheria—Croup—Laryngismus Stridulus—Rickets—Skin Affections—Red Gum—Eczema—Nettle Rash—Ringworm—The Itch—Lice—Worms—Tape Worms—Round Worms—Thread Worms—Diarrhœa—Dysentery—Jaundice—Scrofula—Scurvy—Hip Disease—Ophthalmia—Granular Lids—Ulcer of Cornea—Inflammation of Eyelashes—Squint—Otitis—Convulsions—Infantile Paralysis—Rheumatism.

In any case of serious illness the mother should, at the very beginning, carefully consider:

(1) Shall I be able to nurse the child myself?

(2) Will it be best to have a trained nurse?

(3) Will it be best to send the child to a hospital?

In order to nurse a child through any serious illness the mother will have to give up all her time to the patient. It is useless to think of carrying on the ordinary household duties, while acting the part of nurse. Sometimes, of course, the question is answered at once in the negative by the mother being in a state of ill-health, or so delicate as to be physically unable to withstand the strain; or she may be suckling an infant. In all cases of serious illness it is a great comfort to have a thoroughly trained nurse to look after the child. This is more a question of expense than anything else. A mother, in thus calling in the services of a trained nurse, must not for a moment think that she is giving up her privileges, or her duty to her child. The nurse can do what the mother often cannot do. It is not only love but knowledge that is required, and in some cases the mother herself, through a want of knowledge and training, becomes the chief obstacle to the child's recovery.

Cases of scarlet fever and diphtheria, unless efficient isolation can be carried out, had better be nursed at a hospital, if there be other children in the same house. With poor people, all serious cases of

illness will, with very few exceptions, get well much quicker if sent to a hospital.

It is not a very difficult thing to tell whether a child be ill or not. The loss of appetite, dry skin, and languor, are quickly detected by the watchful mother or nurse, and though, to a casual observer, the child may for a few moments brighten up and appear quite well, the trained eye is not so easily deceived. If a child be very ill, it is always a good sign when it sheds tears; such cases usually recover.

It will be well to consider a little in detail some of the commonest illnesses to which a baby is liable. The following remarks are in no way meant to supersede the doctor, but are given so that the mother or nurse may understand, in some little measure, the nature of the complaint, what course it is likely to take, what are the chief dangers to be feared, and the line of treatment which will probably be adopted.

Bronchitis.

By bronchitis is meant an inflammation of the air tubes of the lungs. In certain states of the weather bronchitis may occur as a regular epidemic; cold, wet, and fog are specially conducive to this disease.

Bronchitis is very liable to set in under the following conditions:

(1) In weak and sickly children.

(2) In rickety children.

(3) As a consequence of an influenza cold.

(4) During attacks of measles and whooping cough.

Inflammation of the smaller air tubes, or, as it is called, capillary bronchitis, or broncho-pneumonia, is always a dangerous complaint in infants. Bronchitis may begin with an ordinary feverish cold, which gradually spreads downward until it reaches the bronchial mucous membrane. There is always more or less fever, the breathing is quick and short, and at the same time labored, so that the nostrils dilate with each breath; the cough is very troublesome, and usually continues during sleep. There is much restlessness and tossing about before the child can find an easy position. The face is often flushed and covered with perspiration. There is a loss of appetite, and oftentimes sickness. If the child be at the breast, there will be inability to suck properly, on account of the want of breath. Infants rarely bring up the phlegm or mucus which is secreted in bronchitis, in the form of expectoration, as grown-up people do, but cough it up into the mouth and then swallow it.

On applying the ear to the back of the chest, wheezing or rattling can generally be heard all over it.

In mild cases of bronchitis, where the larger air tubes are affected, the cough is usually louder, and plenty of air enters the lungs, so that the child, though short of breath, does not pant, turn blue, or dilate its nostrils. The rattling in these cases is louder.

If a child lie quiet, with rapid breathing, blue lips, and a constant little muffled cough it is very seriously ill indeed.

Good nursing is everything in bad cases of bronchitis. The child should be put into a good-sized room with a grate or stove fire; it must be remembered that the little one wants plenty of fresh air, though at the same time it must be warm air. To put the patient into a tiny little bedroom with a roasting fire, is often to take away its only chance. A flannel gown with long sleeves should be worn, as the child is sure to be restless.

The patient may often be quieted by taking him out of bed and nursing him by the fire for a while. A change of position will often afford relief, e. g., turning on to one side, or bolstering up with pillows.

If the child requires washing, and is able to bear it, it should be done in front of a fire, with the bath surrounded by a screen. Immerse the child up to the neck in water at 104°, keep it there for three minutes, take it from the bath, envelop it at once in a warm blanket, and dry under it, so that there is no exposure to the air. Next put on the child's garments, wrap it in a warm, dry blanket, and put it to bed with the blanket still around it.

If the cough be tight and dry, a bronchitis kettle, or kettle to boil water in and form plenty of moisture for the air, put on the fire for a few hours, will often prove of service; it will moisten the air and loosen the cough.

If the cough be loose, a kettle is not called for, and may do harm. To keep a child in an atmosphere of hot steam for several days together is certainly a great mistake. Should the secretion into the bronchial tubes be abundant, and the child seem almost choked with it, it is a good plan to induce vomiting, which will clear off the phlegm and greatly relieve the symptoms. The best emetic is a teaspoonful of ipecacuanha wine.

Poultices are much less used than formerly, though sometimes a jacket poultice made of linseed, with a very little mustard in it, is ordered at the beginning of the illness, to be replaced in an hour or so by a hot cotton-wool jacket. The great thing to be guarded against

is debility, and the child's strength will require to be kept up with appropriate nourishments. Brandy is often necessary. Convalescence is often very protracted, and extract of malt, raw meat juice, or cod-liver oil may be given with advantage. Even when apparently quite recovered, the child should not be taken out of doors until the doctor's sanction is obtained, as a relapse is very common.

A child that has once had bronchitis, is rather liable to have it again, and some children cut each tooth with an attack. In order to prevent a recurrence of the disorder, the child must be braced up, and not coddled. Sunshine, pure air by day and night, warm but not heavy clothing, and an abundance of nourishing food—milk, cream, eggs, etc.—will render him less susceptible. Damp cold—not dry cold—is most to be dreaded.

Inflammation of the Lungs.

This disease is by itself not a very common one among young children, being almost always accompanied by bronchitis, constituting the disorder known as broncho-pneumonia.

In young infants, especially if they be rickety, broncho-pneumonia is very fatal. The treatment is the same as that for bronchitis. Warm, fresh air is required; to allow several sympathizing friends in to help, and to keep up the warmth of the room by burning gas, is but to deprive the child of the great thing needful, viz., oxygen.

Pleurisy.

This disease consists of an inflammation of the pleura, or covering of the lungs, and, unlike bronchitis, is nearly always confined to one side. After the inflammation has subsided, fluid is very apt to be poured out between the lung and its covering. If this fluid increases to any extent, it will so press on the lung that the child will have great difficulty in breathing, and, unless something be done, will be suffocated. In such cases the doctor will draw off the fluid by sucking it through a hollow needle with a pump.

Sometimes, instead of the fluid being clear, it will be thick, like cream; then an opening will probably have to be made between the ribs, and a drainage tube inserted to allow the fluid to slowly drain away. Usually cases of pleurisy do very well. No doubt it is a terrible thing for the mother to be told that an operation is necessary, and that her little darling's chest must be opened; but consent should

never be withheld, it is the best thing to be done, and will in all probability result in a perfect cure.

In all cases of chest disease the child should not be allowed to talk, but be kept as quiet as possible.

Fever.

Every rise of temperature of the body above 98.4° F., which lasts a certain time, is a fever. The simple feverish attacks which are so common in young children have been described elsewhere; we now come to the **special** fevers, each of which is caused by its own special poison.

Some fevers are **infectious**, i. e., their poison may be carried from one person to another. Strictly speaking, the word "contagious" means that the disease is spread from one person to another by actual **contact**, while the word "infectious" means that it is spread without actual contact with the diseased person; but the terms are now often used interchangeably.

Whilst a child is feverish, it is not only useless, but injurious to press it to take solid food. All it wants is to be left quiet, and to be supplied with enough fluid nourishment to allay its thirst.

In cases in which the rash comes out very imperfectly, the child may become very ill. A hot bath is here often very beneficial. The bath should be put in front of the fire, and the child be very slowly let down into it. After being in about five minutes it should be taken out, wrapped in a warm blanket, and put straight to bed without being dried. The temperature of the bath should be 105° F. A bath thermometer should always be used.

When a cold bath is ordered in cases of fever, the child is put into the water at a temperature of about 95° F., and cold water, or even lumps of ice, are added afterwards, till the temperature drops to 60°. Great caution is required whenever baths are used in cases of fever; the child is sure to be very weak, and dangerous collapse may set in. Brandy should always be at hand in case of necessity. The temperature of a child having a cold bath must be carefully watched, and the doctor or a trained nurse is always present during its administration.

In some cases of restlessness and want of sleep, a wet pack is very useful. The bed is first protected by a mackintosh, with a blanket placed over it. A sheet is then wrung out of hot, warm, or cold water, as the case may be, and the child is enveloped in it, with the exception of its head, and is then placed on the bed, the lower blanket being tucked closely over, and two others laid above. The duration of a wet pack is from half an hour to three hours. Besides quieting

the child and inducing sleep, the wet pack will bring down the temperature and so reduce fever.

The Infectious Fevers.

Those infectious diseases which are characterized by a rash are known by the name of **"the exanthemata."** The word "exanthem" simply means a **skin eruption**, but is now exclusively used to denote the infectious fevers which are accompanied by a rash or eruption. The most important exanthemata are chicken-pox, measles, German measles, scarlet fever, small-pox, and typhoid fever.

All the exanthemata are more or less contagious; they all have a period of **incubation**, i. e., there is a period between the **infection** (or exposure) and the **onset** during which the patient has the poison in his system, although it has not shown any signs of its presence; they all present a rash; and, lastly, they are all **specific**, i. e., each is produced by a poison peculiar to itself. A table of the incubation period of the infectious diseases is given below. If after exposure to infection the child does not develop the symptoms of the **onset** by the time mentioned, it has not been infected and therefore will not have the disease. Of course it may develop the disease subsequently from another exposure.

Disease.	Incubation.	Period of Infection.
Chicken-pox	14 days	3 weeks
Measles	12 days	4 weeks
German measles	18 days	3 weeks
Scarlet fever	1 to 7 days	6 to 8 weeks
Whooping cough	10 to 14 days	6 to 8 weeks
Mumps	21 days	3 weeks
Small-pox	9 to 16 days	3 to 6 weeks

Chicken-pox, Varicella, sometimes called glass-pox, is usually a very mild disorder. The child becomes a little out of sorts and feverish, and in about twenty-four hours has a rash. This appears, at first, in the form of small, red, raised spots, or **papules**, which in a few hours become **vesicles**, i. e., filled with a clear watery fluid. The spots do not come out all at once, but in crops, new ones appearing from time to time; they are usually specially abundant on the face and back, and about the head, but the first ones come on the back or chest; they increase in size, become **pustular**, i. e., their contents become milky or yellowish, and they then either burst or dry up about the third or fourth day, forming small scabs which, about the

end of a week, fall off, leaving red stains upon the skin, which slowly disappear. In some cases, especially if irritated and infected with pus-organisms by scratching with the fingernails, a spot may leave a scar. It is important in the diagnosis that the eruption may be seen in all stages at once—papule, vesicle, pustule, and crust. Moreover, the spots are always **discrete,** i. e., do not run together or fuse.

The child will probably require no medicine at all, but must be kept indoors whilst it has the rash, and should be kept from scratching the spots, especially those on the face. A lotion of weak carbolic acid is soothing. It should contain about one part of carbolic acid in two hundred of water. The bowels should be regulated if necessary. The period of infection lasts about a fortnight, but is not over until every scab has fallen off.

Measles (Morbilli, or **Rubeola)** is very infectious, even before the appearance of the rash, so that though a child may be separated from his companions on the first appearance of the rash, the others are almost certain to contract the disease.

At first the child becomes dull, heavy, and feverish, and appears utterly miserable. Sneezing, and running at the eyes and nose set in, and usually a hacking, dry cough makes its appearance. The eyes are reddened. In young children there may be convulsions. On the fourth day of illness the rash comes out, first on the face and behind the ears, and then spreading to the arms, belly, and legs. The mucous membrane of the mouth and throat are also generally affected, so that the child will often have a sore throat. The rash first appears in the form of small red pimples, which quickly increase in size and run together, forming irregular blotches. Whilst the eruption is at its height, the face appears bloated and swollen, and the hands tight and bursting. At this time it is quite common for the temperature to be about 105°, and accompanied by delirium, but as soon as the rash begins to fade, i. e., about the sixth or seventh day of the disease, the fever suddenly drops and the child becomes convalescent. The eruption fades in the same order that it appeared.

While the rash is out the child must be kept strictly in bed, unless indeed it be very young, when it may be nursed. Great care must be taken lest it catch cold, and for this reason it is best to let it wear a flannel nightgown with long sleeves.

The most troublesome part of the complaint is usually the cough. If the throat be sore, give thick barley-water; black currant tea should be given sparingly, as diarrhea may set in, which is difficult to control. During the fever stage the child will probably suffer

from inflamed eyes; they should be bathed with warm water, and the room be kept darkened. About the twelfth day the skin often scales in little flakes. In cases in which the rash does not come out well, the child may become very ill and convulsions set in; a hot bath is then called for.

Some epidemics of measles seem to take a malignant form, but as a rule, with care, children do well.

There is a popular idea that healthy children should be allowed to mix with those who have contracted the disease, so that they may get it over early and have done with it. The idea is **not** a good one. The disease is not such a trivial affair as many imagine, and many a mother has had to regret that she did not take more care of her children by isolating the sick one from the very beginning.

The period of infection lasts a month from the commencement of the attack. Of course; all the usual rules of disinfection must be carried out before the child is no longer a source of danger.

If the fever keep up, and the child be ill after the rash have disappeared, some complication is probably present. The commonest dangerous complications are bronchitis and inflammation of the lungs, but an attack of measles is liable to be followed by various evil consequences:

(1) A chronic state of low health, which should be treated with tonics, and change to the sea.

(2) Bronchitis, inflammation of the lungs, or consumption.

(3) Inflammation of the eyes.

(4) Inflammation of the ears.

German Measles is a disease quite distinct from ordinary measles, and an attack of the one will not afford any protection from the other. As a rule the disease is milder than true measles. The rash appears on the second day of the illness, and is usually very irritable; the glands down the side of the neck are generally enlarged and somewhat painful; cough is usually absent; convalescence is rapid, and is sometimes accompanied by peeling.

Scarlet Fever or **Scarlatina.**—Vomiting or convulsions may be the first symptoms. The **throat** is almost always affected, being very red and swollen; the glands in the neck often swell and become tender. The skin feels very hot and burning, and the rash comes out on the second day. The eruption shows itself at first as small red spots, which quickly spread until the whole skin presents a scarlet appearance, with the original spots showing through, so that the child looks like a boiled lobster sprinkled with cayenne pepper. There is no

disease so unequal in its attacks as scarlet fever; some cases are so mild that the child does not complain at all; usually infants do very well. The mild cases are just as dangerous as others for conveying the disease.

After the rash has reached its height the fever slowly abates, and in a week should have entirely disappeared. Peeling of the skin generally begins about the eighth day, the size of the flakes depending upon the thickness of the skin. It is often not completed under six weeks from its commencement. Infection is very liable to hang about in the clothes of the patient, or in the paper on the walls of the room, and is at its height during the peeling stage, so that the child must be kept strictly isolated until that be quite over. In a mild case the child may be almost well at the end of a fortnight.

The chief complications are:

(1) **Nephritis** or inflammation of the kidneys and dropsy. This usually takes place during the peeling stage, and may have been caused by a chill.

(2) **Rheumatism.** This is dangerous on account of the damage that may be done to the heart.

(3) Inflammation of the **eye** or **ear.**

Like typhoid fever, scarlet fever may be spread by means of contaminated milk, and is an additional reason why all milk should be boiled, so that any germs which are present may be destroyed.

Small-pox.—This disease is quite unknown in infants that have been efficiently vaccinated. The rash appears on the third day, and the eyes are specially liable to suffer.

The younger the child the more likely is the disease to prove fatal. During an epidemic of small-pox, infants should be vaccinated when a few days old, or at once if there is much likelihood of the infant's being exposed to the disease. Proper vaccination is absolute protection against smallpox.

Typhoid Fever is rare in infants. It is characterized by diarrhea and fever. A few spots generally make their appearance on the abdomen about the tenth day of illness. No solid food **of any description** should be given, as the fever is one in which inflammation of the bowels is always present, and any irritation to them in the way of solid food or fruit may cause sudden death. Milk by curding may become a very solid food.

Whooping Cough.—This disease is very contagious. It begins with an ordinary cough, which may last some weeks before the characteristic "whoop" makes its appearance. The infection of the disease

lasts about six weeks, but the risk of infection cannot be said to be positively over until the child quite ceases whooping. In bad cases the fits of coughing will come on every half-hour, or even oftener, and are often accompanied by vomiting. Owing to the violence of the cough, bleeding may occur from the nose, or, more rarely, from the ears, and hemorrhage beneath the mucous membrane of the eyes is very common. If the child have any bronchitis, bed is the best place for it, and a steam kettle with carbolic lotion may be used in the room.

In ordinary cases it is best to have a day and a night room. Early in the day, burn sulphur in the night room, leave the windows open all the afternoon, have a fire, and let the child sleep there. In this way the attack will probably be much shortened. A lamp burning cresoline (to be had of any chemist) may be used in the day room.

If the chest be very stuffy, it may be well rubbed, in front of the fire, with camphorated oil, goose fat, or even plain vaseline. If the child vomit during the fit of coughing, light food, e. g., milk and water or raw beef juice, should be given directly after the attack. The duration of the disease is very variable. The chief dangers are bronchitis, inflammation of the lungs, and consumption. If the patient be rickety, the dangers of whooping cough are greatly increased. When the disease passes into a chronic stage, i. e., after about two or three weeks, in suitable weather the child should be out as much as possible, and later on a change to the seaside will often effect wonders.

The child while still whooping should not be allowed to go near other children; and it should be remembered that the contagion can be transmitted by the mother or nurse.

Diphtheria.—This is a contagious disease characterized by the deposit of a whitish-gray membrane, which usually appears in the throat. There is fever, loss of appetite, lassitude, and a difficulty of swallowing. Sometimes, however, these symptoms are so slight as not to be noticed at all. On examining the throat the diphtheritic membrane is usually plainly to be seen on the tonsils, uvula, or adjacent parts. Vomiting is often present. Hoarseness or loss of voice points to a spread of the membrane to the windpipe; a copious discharge from the nose may indicate a spread of the disease to that organ. Lumps, due to enlarged glands, usually appear on each side of the jaw.

A doctor should always be sent for **at once.** A case of diphtheria, however mild it may appear to be at first, may prove fatal in the

long run. Diphtheria antitoxin (or anti-diphtheritic serum) must be given as early as possible and in sufficient quantity. It usually causes rapid recovery. When the child is first taken ill, it is not always possible to say whether the disease will turn out to be diphtheria or not, but it is best to isolate the patient and put him to bed at once.

In cases where the mother decides to look after the child, she must be completely shut off from her other children.

During the first few days the child will probably have great difficulty in swallowing, and will keep its mouth open, allowing the saliva to trickle on the pillow. The great thing is to keep the strength up as much as possible. Stimulants will probably be necessary, and food in the form of milk, eggs, soups, beef-tea, etc., given in small quantities very frequently. In bad cases the child must be kept perfectly quiet, and not even allowed to sit up in bed to take its food. The three chief dangers are—

(1) **Exhaustion.**—In some cases, though the throat itself goes on well, the complexion will get of a waxy hue, the pulse becomes slower and slower, and the child will gradually pass away. Sometimes, when the child has been allowed to make some sudden movement, or has suddenly sat up in bed, it has dropped back dead. This is due to heart failure; the poison formed by the diphtheria germs acts especially on the nervous system and on the heart, causing paralysis. Vomiting occurring after the first few days is a very bad sign, and quickly leads to exhaustion.

(2) **Suffocation.**—If the membrane spread to the windpipe, the breathing will become labored, the nostrils will dilate, and the ribs fall in at each inspiration, and unless something be done, the child will die suffocated. In suitable cases, opening the windpipe affords the only hope. The operation itself is not a dangerous one, and the longer it is deferred, the less likely is it to prove successful.

(3) **Paralysis.**—If, when the child swallows, some of the fluid returns through its nose, some paralysis of the soft palate may be suspected. Squint, or weakness of a limb, are also signs of paralysis. Sometimes the paralysis spreads until the child cannot move at all, and it may prove fatal; but, as a rule, it is quite recovered from. No case is hopeless. The paralysis may not appear for some time and may get slowly worse and then disappear more quickly than it came.

All orders from the doctor should be carefully carried out. Sometimes the throat has to be sprayed or painted every two or three

hours, and the mother should be very careful while doing so, that the child do not spit or cough in her face; indeed, it is best to wear a small mask over the face for protection.

Bad drains and contaminated milk are the two great causes of diphtheria, and should both be carefully considered in trying to discover the origin of the disease.

It is astonishing how long the infection lasts, and careful disinfection must be carried out.

The diseases which are most likely to be confounded with diphtheria are quinsy and scarlet fever.

Croup and Child Crowing.

The common history of an attack of croup is as follows: The child, apparently in the midst of good health, suddenly wakens up in the early hours of the morning, gasping for breath. Its face is blue and covered with a cold perspiration, and the breathing is slow, labored, and noisy. The voice is reduced to a whisper, and there is an occasional harsh cough. After a time, varying from half an hour to an hour, the symptoms slowly subside, and the child falls asleep, to wake in the morning quite well, with the exception of a slight hoarseness, and an occasional cough. The child is very liable to get another attack on the following night, about the same hour. Although very alarming, these attacks are very seldom fatal. The child, for the time, seems on the eve of suffocation, but, as a matter of fact, there is not very much danger. The quickest way to cut short an attack is to make the child vomit. For this purpose give a teaspoonful of ipecacuanha wine, and repeat it if necessary. A hot bath with a tablespoonful of mustard in it, will also prove beneficial.

The commonest exciting factor in this disease seems to be exposure to damp cold.

Laryngismus Stridulus, or "**Child Crowing.**"—This disease is characterized by the child being suddenly seized with a spasm of its breath. The child stops breathing, turns blue, clenches its hands, and then suddenly draws in its breath, with a low crow, and is well again. In those who are subject to this complaint any sudden shock will produce an attack, e. g., tossing the child up in the air, or giving it a smack. The voice remains unaffected. The attacks are very frightening, and are sometimes, though rarely, fatal. Should a seizure seem to last longer than usual, dash cold water in the child's face, or give it sharp smacks on the back. It is a disease that children grow

out of as they get older. A doctor will probably order bromide of ammonium, which will assist in the recovery.

The general treatment is that of rickets; nearly all children subject to child-crowing are, at the same time, rickety. Feed the child properly, give it plenty of air and sunlight, and the fits will probably soon cease forever.

Rickets.

This common disease among children may almost be defined as "wry bones;" for though it is not confined to them, it is principally to be seen in the bones. Rickets is a disease affecting the whole body, although it is not usually recognized by mothers until the changes in the bones are noticeable. The ends of the long bones enlarge, and produce swellings at the ankles and wrists. Little lumps also often form where the ribs join the breast bone in front, forming the so-called "rickety rosary," and the chest becomes triangular shaped, like that of a pigeon. As soon as any pressure is brought to bear upon the bones they bend; e. g., as soon as the child begins to walk, and the weight of the body has to be borne by the legs, they will give, producing what is called "bow-legs." If the child sits up much the back will bend. The bones being so soft are very liable to fracture (vide "green-stick" fracture). The head enlarges, and the anterior fontanelle (or space in the bones of the top of the head) does not properly close. The teeth are late in coming.

One of the earliest symptoms of the disease is profuse **sweating** of the head and neck, especially during sleep, and the child will often throw off the bedclothes and lie naked, even in winter. The belly gets big and protuberant, and the motions are often offensive. Although very likely the child does not seem to lose flesh, it will get flabby and will not like to be touched, as it becomes tender all over. If the child have begun to walk it will become unsteady, and the enlargement and bending of the bones will soon be noticed. A rickety child is very liable to attacks of bronchitis, croup, diarrhea, etc. It is very important that mothers and nurses should be able to detect the earliest symptoms of rickets. A doctor is often consulted for the croup or bronchitis, which might have been entirely averted if the true cause had been earlier recognized. A cold which a healthy child would throw off in a few days, will often in a rickety one develop into bronchitis, and may even end fatally. The nervous system of rickety children is very easily upset, so that convulsions and child-crowing are common.

Rickets **is a preventable disease,** and ought never to occur in the children of mothers who have read this book. The causes are bad food, bad air, damp, cold rooms, want of sunlight, want of exercise, and want of cleanliness.

To prevent rickets children must be—

(1) Fed on food suitable to their age.

(2) Kept in well ventilated, dry rooms, free from bad smells.

(3) Given plenty of light and sun-baths.

(4) Given out-door exercise every fine day, and in-door exercise every wet day.

(5) Given soap and water baths at least once a day.

Now these are not impossible rules, except perhaps to a very few, and even then a little ingenuity will often accomplish wonders.

Each rule has been carefully considered in its practical aspect in other parts of the book, and it is to be hoped that every mother will try to work out and improve upon the various suggestions made.

Supposing, however, that all the five rules have apparently been faithfully carried out, and yet the first symptoms of rickets appear, what is the cause? In all probability the first rule has been **unwittingly** broken, e. g., in the case of a child with a weak digestion, the milk has been diluted to such an extent that the child has been half starved. The great remedies here will be **raw meat juice** and **cream** or **cod-liver oil.**

If a child with commencing rickets has reached the age of crawling or walking, its legs must be bound together during the day with a piece of flannel. At night leave the legs loose, so that it may kick about as much as it likes. The only use of having the legs bound together is to prevent the child standing or crawling, because it must be remembered that, directly weight is put upon the bones they will bend.

Bad cases of rickets may require splints, but if the child be kept off its feet from the very beginning, and the five rules above given be carefully attended to, it will quickly recover and the bones get strong.

Rickety infants are liable to an acid form of indigestion, and they bear starchy foods badly; what they require are eggs, milk, raw meat juice, and cream. Kepler's extract of malt makes a capital aid to their digestion, and cod-liver oil is generally the only medicine called for. With young infants a tablespoonful of saccharated lime water in each bottle, replacing the same amount of barley water, is

often beneficial. Rickets, although not a fatal disease in itself, may, indirectly, cause death from bronchitis or diarrhea.

It is interesting to know that formerly it was found impossible to rear young lions at the Zoological Gardens, as they always succumbed to rickets. Now that raw meat, pounded bones, and cod-liver oil have been added to their diet, the cubs have been brought up without any difficulty.

Skin Affections.

If there be one thing more than another upon which a mother is apt to pride herself, it is the fact that her baby always has such a clear skin. Any skin disease, however slight, thus becomes a source of great annoyance, not only to the child but also to the mother. The skin of a child is very delicate and sensitive, and any chafing or irritation, e. g., the using of a coarse soap, will probably bring out a rash.

Nævus, or **Mother's Mark,** is a very common congenital skin affection, which may occur anywhere, and consists of dilated blood-vessels, which may be either of a bright scarlet or dark purple color; the blood can generally be pressed out, so that the spot becomes quite pale.

It really exists at birth, though it may not be noticed for some time later. If situated on a part that does not show, it would better be left alone, providing it is not increasing in size. One that has remained unchanged for a long time, may suddenly increase in size, and then something will have to be done. Different nævi require different treatment; cures are usually effected by painting them with acids, vaccinating them, and tying them, or, in some cases cutting them out. Some nævi are specially adapted for treatment by electricity.

Red Gum.—This rash usually shows itself in infants under a year old, in the form of small, bright, red spots, generally on the face, but often covering the whole chest and body. As a rule the rash is not very irritable, and begins to disappear in a few days. Fresh crops of spots are, however, very apt to come out. The appearance of red gum usually indicates some amount of indigestion and acidity, and is often associated with teething. The best thing is to give a dose of magnesia (Phillip's "Milk of Magnesia" is excellent) to clear the bowels, and five grains of bicarbonate of soda, about as much as will lie on a dime, in a little milk, to correct the acidity. The rash may be dusted with starch powder, or with a good talcum toilet powder.

Eczema.—This eruption has the appearance of a bright, red, moist surface covered with dried-up discharge in the form of crusts or scabs. The most common parts to be affected are the face and scalp and behind the ears; the groins and inner or flexor sides of the joints are also very liable to be attacked. In some instances a child is one mass of eczema from head to foot. In cases of acute eczema, the irritation is very great, and if allowed, the child will almost tear himself to pieces. The discharge from the sores, if allowed to run over the healthy skin, will irritate it, and cause the disease to spread.

In treatment the great thing is to find out the cause, which is commonly some error in diet, e. g., bringing up a young infant on starch food, which causes irritation of the bowels, indigestion, and irritation of the skin. Any irritation, e. g., that of friction or rubbing of the part, that set up by lice, or that of teething, may very quickly induce an attack of eczema. Scrofulous children are also very subject to this disease.

All sources of irritation should be removed, and, if necessary, the child must wear gloves at night to prevent him scratching himself. This, however, is not curing the trouble nor really doing the best thing for the child unless as a temporary measure. Better use a soothing powder or paste.

Soap should not be employed for washing the part, but oatmeal water or sweet oil may be used when cleansing is absolutely necessary, though the less it be washed the better. The ordinary soaps contain free soda and potash, and these act very injuriously in eczema. Water is also not a good thing for an eczematous part of the skin.

The bowels must be regulated and the food carefully attended to. In older children sweets, raw fruit, and much meat act injuriously, and must be withheld.

Locally, the places may be gently sponged with a solution of bicarbonate of soda, containing oxide of zinc, or a solution known as Startin's paint. Soothing or sedative applications are most useful during the discharging stage of the disease, when there is much itching and smarting, and stimulating ones during the scaly stage. It is of no use to apply any medicament on the top of a lot of scabs. The part should first be well soaked in oil, and the crusts picked off; if, however, they still adhere, a poultice had better be used. The best ointments are the zinc, and the white precipitate, which last should be used diluted with lard.

The general health is of great importance, and extract of malt, steel wine, or codliver oil should be given when required.

Eczema is often a very difficult thing to get rid of, and relapses are common. After the child seems quite well again, any little irritation, e. g., the raw wind, will very likely bring back the disease as bad as ever.

Ivy Poisoning.—The intolerable itching may be relieved by plain water, baking-soda and water, lime-water, lead-water and laudanum, grindelia robusta, or by sugar-of-lead dissolved in alcohol.

Hives, Nettle Rash or Urticaria.—An acute attack of nettle rash is usually due to some error in diet, the rash appearing as raised white lumps surrounded by a halo of congestion. The irritation is intense, and may be accompanied by diarrhœa and vomiting.

The best treatment is to give a dose of castor oil, and a bath containing two ounces of soda to three gallons of warm water, and, after drying, to dust on some oxide of zinc powder. The bowel is over-acid, and this should be corrected by magnesia in repeated doses. The attack usually lasts two or three days, and the eruption may come and go several times in a day or two. Sometimes, however, a chronic form attacks children, lasting in some cases months or even years, getting better at times and then breaking out again as badly as ever. The treatment is not always most encouraging in its results, but should be persisted in. Attention must be paid to the bowels and diet. Sulphur, given internally, often does good. The itching may be allayed by a lotion of liquor carbonis detergens, a tablespoonful to a pint of water, dabbed on with a sponge, or by a lotion of a few drops of carbolic acid and of camphor spirits in water, or by other soothing powder or lotion.

Fig. 235. The common flea. Much magnified.

Ringworm.—This complaint is caused, not by a worm, but by a vegetable fungus. It is very contagious, and spreads by children using the same towels and brushes, putting on each other's caps, or by direct contact during play or sleep. The eruption is somewhat irritable, and often causes scratching. At first it appears a dull red circular patch, often covered with little scales; this patch slowly increases in size, fading somewhat in the center as it spreads.

If ringworm attack the head, the hairs in the affected part will break off near the surface of the skin, leaving a bald patch. The hairs do not drop out by the roots, but snap off, so that a small portion appears above the skin. These broken-off hairs are very characteristic of the disease, and at once distinguish it from patches of mere local baldness.

The treatment is to be directed to killing the fungus, which is the real cause of the disease. A patch of ringworm on the arm or leg is very easily cured, but ringworm of the scalp is a most tiresome and vexatious thing; month after month the mother may diligently persevere in the treatment, and yet the case may remain uncured. Such cases require vigorous measures.

If ringworm attacks the scalp, and there be several distinct patches, it will be quicker in the end to have the head completely shaved, and to let the child wear a skull cap. Before applying any remedy, the patch should be cleansed with hot water and soap. An ointment of a dram of salicylic acid to an ounce of vaseline, thoroughly rubbed in, is excellent. Iodine in the form of the liniment, or in the case of young children the tincture, may be painted on. Another good lotion is sulphurous acid, rubbed in with a rag; its smell is, however, rather objectionable. Stronger remedies may sometimes be required.

The child must have a separate brush and towel, and of course must be kept away from school until quite well.

The pulling out of diseased hairs by forceps will hasten the cure. It is always difficult, and often indeed impossible, for a mother to know when the disease is really cured, but a doctor can always tell by means of the microscope if there be any fungus still left.

The Itch, or **Scabies,** is a skin eruption, dependent upon the irritation of an insect, the itch insect, in the skin. The parts mostly affected are the hands, feet, and buttocks. The irritation is always great, and the scratching of the infant is liable to set up eczema. At first the eruption appears as little watery heads, which are soon filled with matter.

The female insects burrow in the skin, whilst the male crawl about the skin and clothes. They are very small, not being as large as a pin's head. The face is never attacked.

The treatment is as follows: Give the child a hot bath, using coal tar soap, and being especially vigorous over the affected parts. Keep the child in the water about a quarter of an hour, so that the

skin may become thoroughly softened; next dry, and well rub in a mixture of a teaspoonful of balsam of Peru to one ounce of vaseline. All the clothes should be baked in the oven. Balsam of Peru is better to use than sulphur, being less irritating. Put the child to

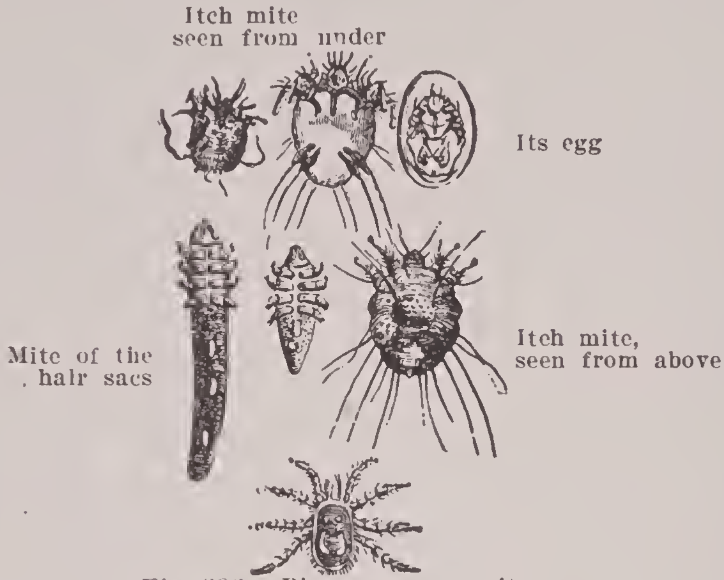


Fig. 236. Bird louse or mite.

bed, and in the morning give a warm bath to get rid of the ointment. Of course, the itch is very catching, and the mother and nurse are very liable to take it from the child.

Lice.—These disgusting insects, politely called "pediculi" by the

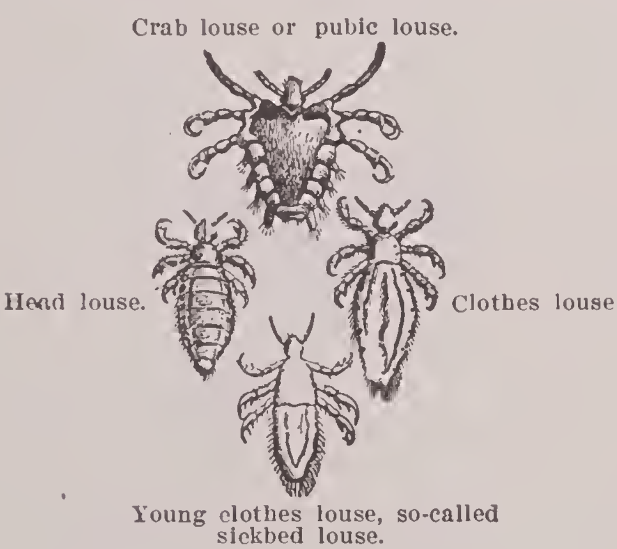


Fig. 237. Lice can be gotten rid of only by strict cleanliness of the person and clothing and bedding. Cutting the hair short, bathing (especially with the use of a carbolic solution, 1 in 100 parts of water; or corrosive sublimate solution, 1 part in 2,000 of water): using white precipitate or gray mercuric salve is the quickest way of killing the vermin. Coal oil (petroleum) is also a quick remedy. The eggs or "nits" must be destroyed by heat, boiling or an antiseptic wash. Green soap and Peru balsam are useful applications for the hair in such cases.

doctor, cause very great irritation of the part affected. Their favorable point of attack is the head, and, by diligent search, they can be easily discovered when present. The eggs are of an oval shape and are glued onto the hairs. Lice cause eczema, especially that

form which is situated at the back of the neck, and the glands in the neighborhood are often enlarged.

The usual treatment is to wash the head with a carbolic acid or sulphurous acid lotion, and use the stavesacre ointment. The strength of the lotion should be one part of acid to fifty of water, and care must be taken that it does not run down the face or into the eyes. Washing the head with corrosive sublimate soap, or with a solution of 1 part corrosive sublimate in 1,000 parts of water, is also very efficacious; the head should be well rinsed after use to avoid irritation by the corrosive sublimate. Methylated spirit applied with a sponge will detach the nits from the hairs.

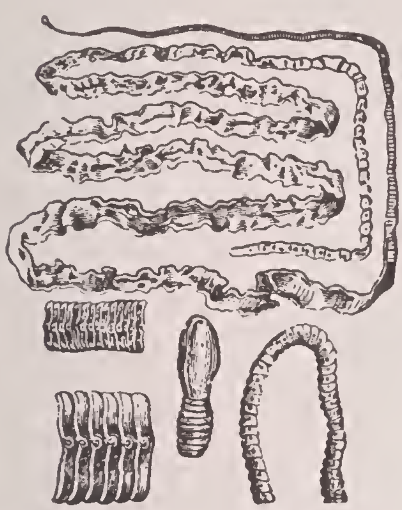


Fig. 238. The broad tapeworm (with pitted or dimpled head). Occurs in northern Europe and in Japan or in immigrants from those parts.

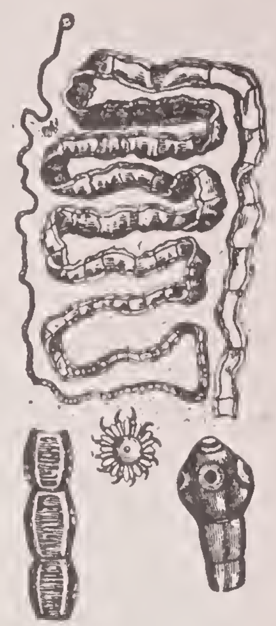


Fig. 239. The common or chain tapeworm. The slender part is the head end. Below are shown three joints or segments, one of the circles of hooks which hold the tapeworm in place, and the head (on which are seen several circles of hooks). The segments form next the head and gradually mature as they are displaced (by new segments) toward the tail end, where they drop off singly or in groups.

Worms.

There are three varieties of worms by which a child may be infested: the tape worm, round worm, and thread worm. The symptoms that may be caused by worms are: Irritation and consequent scratching at the anus, grinding of the teeth, picking at the nose, disturbance of the bowels, and capricious appetite. In many cases, however, the presence of worms gives rise to no symptoms at all.

Tape Worm.—It is rare for tape worm to infest infants. By appropriate means they can pretty easily be got rid of. Flat pieces of the worm are passed with the motions of the child. A cure will not take place until the head of the animal is passed. It is the small end.

Round Worms are several inches long, and have somewhat the appearance of a common earth worm. They vary in number, but

are usually single. It is not a very uncommon thing for the child to expel the worm from its mouth by vomiting. The usual treatment is santonin, given under a doctor's orders: it may be mixed

Fig. 240. Round worm. The male is 4 to 8 inches long, the female is 7 to 12 inches long. Occurs in the small intestine in children, or in the stomach. Looks much like an ordinary earthworm. The eggs are in the stools and get into drinking water, by which they reach the intestine of another persons. Causes excessive appetite, colicky pains, excessive flow of saliva, bad breath, itching of the nose and grinding of the teeth, especially at night. These symptoms may, however, occur when no worms are present; in any case in which these signs are observed it is well to give an active purgative (senna or citrate of magnesia) and to examine the resulting passage from the bowels.

Treatment is simple. Give a full dose of a cathartic, and after it acts give a two-grain dose (½ to 1 grain for a child) of santonin night and morning for three days: then give a grain of calomel or a dose of salts (Epsom, Seidlitz or Rochelle).

with a little powdered sugar, and given at bedtime. A dose of castor oil is generally given the next morning. In two or three days' time the treatment may have to be repeated.

Thread Worms.—These worms, when present, usually exist in

Fig. 241. The thread-worm or pin-worm which occurs in the large bowel, *a*, male, magnified; *b*, male natural size; *c*, female. They cause great irritation and itching, especially at night. The patients (usually children, but not always) become very restless and irritable, the sleep is disturbed, the appetite poor, and there may be anemia. The worms are readily seen in the feces or stools, in which immense numbers of the eggs are also present. These get into water or on raw vegetables, such as lettuce or cresses, and thus convey the disease to other people, or renew it in a patient who has been cured of it. *Treatment: Santonin* in small doses, mild purgatives, especially *rhubarb;* large injections of infusion of quassia, aloes, or of strong salt water (a tablespoonful to a quart of cold water), or of water and turpentine (a teaspoonful to a pint). The injection must be given with the patient lying down and having the hips well raised. Treatment must be thorough, being continued for ten days and repeated if necessary in a month or two. The hands should be washed in strong vinegar or in acid water (a teaspoonful of muriatic acid to a pint) to destroy the eggs. For the itching, use vaseline or belladonna ointment at night.

large numbers. They are only about a quarter of an inch long, and inhabit the lower bowel, and often escape from the anus and crawl about in its vicinity. If there be much mucus secreted from the bowel it seems to afford a convenient resting place for the worms to breed and multiply.

The best treatment is injections into the lower bowel of salt and water, a teaspoonful to a pint, or an infusion of quassia of the same strength. In young children, not more than three or four ounces of injection should be used at a time. It is well to repeat the operation for a few days, night and morning, at the same time keeping the bowels open.

In some cases it is best not to give injections, but to give santonin, the same as for round worms. Worm cakes are sold by chemists, but, as a rule, are not very satisfactory, the quantity of santonin they contain being very uncertain.

In all cases of suspected worms the motions should be carefully examined, as it is impossible to arrive at a correct diagnosis unless the worms, or their eggs be seen.

Diarrhœa.

Of all diseases to which infants are subject, summer diarrhœa is by far the most fatal. Of 15,000 deaths among children in New York, 13,000 were from this complaint. In olden times, at the foundling hospitals, of every 100 infants brought up by hand, 60 to 80 died of diarrhœa before they were a year old.

The bowels of a healthy infant usually act two or three times a day at the commencement of its career, the motions being of a bright yellow color, not markedly offensive, and containing but few traces of undigested curd or casein. If a child be passing six or seven motions daily, it is probably passing, at the same time, a good deal of undigested food, in the form of large white masses of casein.

The great causes of infantile diarrhœa are **errors in diet** and **want of cleanliness.**

The mucous membrane of the child's stomach is exceedingly delicate, and it is not slow to resent any irritation. Big lumps or curds in the stomach are sure to cause trouble, and sooner or later will set up vomiting and diarrhœa.

The great preventives are proper food and cleanliness. Any error in diet is liable to cause irritation, and the stomach and intestines both get rid of the offending substance as quickly as possible: it is no marvel, therefore, that vomiting and diarrhœa often

accompany one another. And it is always much easier to start a diarrhœa than to stop one.

In an analysis of 710 cases of fatal infantile diarrhœa it was found that 393 had had no breast milk, 287 had been fed on a mixed diet, and only 30 had been brought up on breast milk alone.

Infantile diarrhœa is far commoner in summer than in winter, on account of the greater liability of the food to ferment and decompose. Sometimes it sets in as a regular epidemic; the worst months are June to August. Hand-fed infants, among the poor, are heavily handicapped during the summer months; it is so easy to forget that the least trace of sour food will poison a whole meal, and perhaps endanger the child's life. In cases where the mother goes out to work, and the infant is hired out to ignorant people to feed, the mortality during the summer months is so great that these said nurses are known as "angel-mongers."

Infantile diarrhœa, or **gastro-enteritis**,[1] begins by the bowels acting more frequently than they should do, then the yellow motions change to a green substance like chopped spinach, and at last they resemble offensive ditch water. Their frequency varies very much, amounting in some cases to three or four times in the hour. Vomiting is usually set up at the same time. The rapidity with which infants succumb to this disease is awful. The breathing becomes quick and shallow, the anterior fontanelle sinks in, and the child, who at first was hot and feverish, now lies on its back, collapsed and cold to the touch. A plump, healthy child may be almost unrecognizable at the end of three days' time, the sunken eyes and leaden face giving it quite a different appearance.

Treatment.—Call in a doctor at once, before the child becomes hopelessly ill. A diarrhœa should never go on unchecked. Give the child plenty of air, putting it into a large cool room. If possible, arrange that different persons should feed and change the child. Auto-infection[2] has been proved to play an important part in the relapses which are so frequent, and therefore the hands of the one feeding the child should not run any risk of being contaminated by fecal discharge. Not only should soiled napkins be removed immediately, but the child should be changed to another room than the one it generally occupies. It should be kept very quiet, lying in a cot near a widely open window, which should be on the

[1] *Gastro-enteritis* is inflammation of the stomach and bowels.

[2] *Auto-infection* is self-infection, i. e., the germs of the disease are discharged from the body and then taken in again by the mouth.

cool side of the house in summer. A woolen binder must be worn, and a hot bottle kept near the feet, if they are chilly. Moving from town into the country often proves beneficial.

To persistently give the child food when it is vomiting and has diarrhœa, is absurd, although the mother gives it with the idea of "keeping up the child's strength." The child's inside wants a rest: to feed it up is to take away, may be, its only chance. In bad cases discontinue all milk food. Beat up the whites of two eggs with half a pint of thin barley water, and of this give one tablespoonful every hour for twenty-four hours—or longer. Should the child be collapsed, brandy, in the proportions given (in the next under "Alcohol"), can be added to the mixture every third or fourth hour, and a warm bath with a small tablespoonful of mustard in it will help to revive the infant. Sometimes two teaspoonfuls of raw meat juice may be alternated with the egg mixture with great advantage. Whey may also be given for the same length of time. After twenty-four hours in mild cases, or forty-eight in more severe ones, milk which has been fully peptonized should be cautiously begun in small doses, returning very gradually to the usual diet. To sum up the treatment: **Strict attention to diet, plenty of fresh air** and **scrupulous cleanliness.**

Dysentery.—Dysenteric diarrhœa is characterized by a discharge of blood and mucus from the bowel. This disease is not, as a rule, due to errors in diet, but to a chill of the bowels, setting up inflammation. Usually there is a good deal of straining and bearing down of the bowel, and at the outset there may be fever and vomiting.

The great preventive of dysentery is the proper protection of the bowels from cold; for this reason a stomach belt should be worn by day and night. The line of treatment is to give the bowels as much rest as possible, allowing only barley water and egg as before described.

If a child passes blood and mucus with great straining, and at the same time has constipation, a doctor should be sent for at once, as the child probably has **intussusception of the bowel**, i. e., one portion of the bowel has slipped into another like an inverted finger of a glove. Any purgative will make matters much worse, and an early operation is generally required to save life.

Jaundice.

It is a very common thing for a child of three days old to become jaundiced and yellow all over. This, however, is of no con-

sequence, and disappears in a week or so. In older children, jaundice is usually due to a cold on the liver, which produces congestion of that organ, and a temporary stoppage of the bile ducts. The urine is of a dark yellow color, and stains the napkins. The motions are of a pale white color, showing an absence of bile. Sickness may be present, and the bowels are generally confined. The stomach should be kept warm, and well covered up, and, unless the weather be warm, the child should be kept strictly indoors until the jaundice has quite disappeared. The disease requires careful management, but need cause no anxiety.

Scrofula, Struma, or "King's Evil."

This disease is really a form of **tuberculosis.** The tendency to it is hereditary, and should two scrofulous persons marry, their children will almost certainly become affected sooner or later.

Scrofula manifests itself in many ways, notably in diseases of the glands and joints, and in older persons in disease of the lungs, causing consumption.

A child who inherits a scrofulous constitution will require very great care from the time of its birth. A slight illness which in a healthy child is quickly recovered from, will often, in the scrofulous child, lay the seeds of a fatal disease, e. g., a diarrhœa set up by improper feeding may prove the starting point of consumption of the bowels.

If a child has a marked scrofulous tendency, it will probably carry it all through life, but if there be only a slight tendency, it may be eradicated by careful hygienic treatment. The successful treatment of scrofula does not lie in medicines, but in suitable food in sufficient quantity, plenty of outdoor exercise, thorough ventilation of all the rooms, supplemented by country or sea air as often as possible. In weaned children, a large quantity of milk should still be systematically given. The appetite of scrofulous children is often very capricious, but a good allowance of milk, milk puddings, eggs, etc., should be firmly insisted upon. To give way to a child's whims in these matters often means the first step in a downward course of health, and the great majority of children, both in wealthy and poor households, are underfed in these requisite articles of diet.

Codliver oil, either as an emulsion or in malt, is most valuable in these cases, and should regularly be given through the winter months, when it is increasingly important to keep up the supply

of animal fat. Good cream as an article of diet, or plenty of good butter is as valuable as codliver oil.

Scrofulous children are very liable to swollen glands in the neck; these may require removal, as, if allowed to burst, they may go on discharging for many months and leave very ugly scars. Discharge from the ears, which is also very common in these cases, should never be neglected, as total deafness may result. A swelling of the abdomen, accompanied by great wasting of the child, is usually a sign of consumption of the bowels. The eyes and eyelids are very liable to suffer. and will require special care. Convulsions, squint, screaming, with rolling of the head from side to side, are signs of a scrofulous inflammation of the brain, i. e., tubercular meningitis. Scrofulous disease of the joints is described elsewhere.

Enough has been said to show parents the necessity for a watchful care and special supervision, if there be reason to suspect a scrofulous taint in their family.

Strumous children being generally "delicate," it is often considered necessary that they should be coddled and shut up nearly all the winter in hot, ill-ventilated rooms. If the child really be scrofulous, and be treated in this way, it will afford a splendid opportunity for the scrofula to develop and rapidly increase. Always bear in mind that they require more air than other children, and if they be warmly clothed and accustomed to it, cold air will not hurt them, but will act as a tonic. If obliged to be kept in for wet weather, the regular ventilation of the rooms should be supervised by the mother herself.

Scurvy.

The now very general use of peptonized and sterilized milk and patent foods has caused the disease known as infantile scurvy to be far more common than formerly, and in contradistinction to rickets, it is found more among the well-to-do than the poor.

It is characterized by tender bones, swellings on the limbs, hemorrhages under the skin, spongy gums, anæmia, earthy complexion and smell, and great debility, and is caused by the lack of **fresh food.** It is most common between the ages of six and eighteen months, and its occurrence calls for an immediate change to fresh boiled milk, raw meat juice, and mashed potato, but of course medical advice must be sought.

Hip Disease—Morbus Coxæ.

This very rarely attacks infants; indeed, it is very rare under three years old, but its early recognition is so important that a few words are necessary. To take it in time is the great thing. A child, generally between four and ten years old, will begin to cry out in its sleep; it is a sudden, sharp cry, not necessarily waking the child. Soon the child will be noticed to walk with a slight limp, and complain of pain, probably in one knee; he does not jump about and play as usual, but goes carefully, as if he were afraid of any sudden jar to the foot. He should be taken to a doctor at once. The disease is a scrofulous inflammation of the joint; in other words, it is tuberculosis of the hip-joint. The treatment will require great patience. (See also in the Index for a fuller description.)

Complete rest to the joint is required, and in order to carry this out, the child will probably have to lie on his back, quite flat, for several months, and have a weight attached to the bad leg.

If all goes well, after some months he will be allowed to get up and walk on crutches, having the hip fixed in a splint.

In bad cases, abscesses form around the joint, and an operation may be necessary. Even in favorable cases there may be a perceptible limp in the walk after the child gets quite well.

Hip disease is very serious, not only with regard to the joint, but even the life of the child. Poor persons would far better, if possible, get the child into a hospital; the case will be one certainly of months, possibly of years.

A table, with specially arranged apparatus, has been invented to enable a child to play with his toys while lying on his back.

Ailments of the Eyes.

Ophthalmia is an inflammation of the membrane covering the eyeball and lids. We have already seen how prone newborn infants are to suffer from this disease. Unfortunately, ophthalmia is very common in older children, especially those who are strumous.

The white of the eye becomes red and swollen and a thick yellow discharge exudes from it. In some cases the swelling is so great that the child cannot open the lid. The lids are generally glued together in the morning by the discharge which has been secreted during the night.

The great cause of ophthalmia is overcrowding and want of fresh air. In every case of eye trouble a doctor must be consulted

at once, as delay may prove dangerous. The discharge is very contagious, and one eye will often infect the other. The child must be kept separate, and every precaution be taken to prevent the disease spreading to others. The eye should be cleansed and bathed with warm water and absorbent wool, a fresh piece being used each time, after which an astringent lotion of alum, sulphate of zinc, or nitrate of silver, half a grain or one grain to the ounce, is often employed. The lotion must really get inside the eye or it will do no good. The child should be taken on one's lap, the head thrown well back, and the lids gently separated. A pipette with a little india rubber cap, sold for the purpose (and called a "medicine dropper") is the best instrument to use for dropping in the lotion. In bad cases this operation may require repeating every hour the child is awake. The lids should be smeared with a little vaseline to prevent their sticking. The general health must not be forgotten, and an abundance of fresh air is absolutely necessary. If ophthalmia be neglected, the inflammation is **very** apt to spread to the ball of the eye itself and destroy sight.

There is a form of ophthalmia which affects the part covering the inner surface of the eyelids, which is apt to assume a chronic form, and gives rise to what are called "granular lids" or **trachoma.** In this form of the disease, the constant movement of the lid keeps up the irritation, and the affection becomes troublesome. In many of these cases the lids will require turning inside out and touching with a stick of blue stone daily.

Ulcer on the Eye.—An ulcer on the front part of the eye or cornea is always accompanied by pain, watering of the eye, and a fear of light. It always denotes ill health or scrofula, and may follow an attack of measles or scarlet fever. The eye generally waters a good deal, and the child will absolutely refuse to allow it to be looked at. The latter is due to the inflammation and sensitiveness **within** the eye. The fear of light is termed **photophobia.** The cornea has a milky spot on it, due to the presence of large numbers of white blood cells. There are no **blood vessels** in the cornea, hence there is no **redness** in inflammation here. But owing to the inflammation, blood vessels may grow into and over the cornea from the white of the eye. This causes permanent loss of transparency of the cornea and hence more or less blindness. The general treatment consists of tonics, e. g., codliver oil, steel wine, or malt extract, good food and plenty of fresh air. The eye should be carefully protected by a shade or veil while the child is out of

doors, but while indoors it is better to slightly darken the room. To keep the child shut up in a dark room from morning till night to mope and fret will prove most disastrous.

The child must be taken to a doctor, who will probably order an atropine lotion to be dropped into the eye twice a day, and perhaps a blister on the temple.

An ulcer on the cornea, even when healed, leaves a little white spot or scar behind it, which, if over the pupil, may interfere with the sight. Neglected cases of corneal ulcer may lead to the destruction of the eyeball.

Inflammation of Eyelids.—Among poor children an inflammation about the roots of the eyelashes is a very common disorder. The edges of the lids become red and irritable, and a thick secretion is poured out which glues the lids together. Scabs form and the lashes drop out, causing a very unpleasant disfigurement. The great essential in treatment is **cleanliness** and **tonics.** The scabs should be bathed off, and a little dilute yellow oxide of mercury ointment smeared on. A child that has once had the disease is very liable to have it again.

Squint.—Cases of squint or cross eyes are usually due to some slight malformation of the eyeball, and should be seen by a doctor at once—if possible, a good **oculist** or eye specialist. Some cases can be cured by spectacles, others require an operation.

Headaches over the forehead, and blurring of objects, point to a defect of vision, and the child should be examined at once, as it may be ruining its sight as well as its nervous system.

The Ear.

Otitis Media, or inflammation of the middle ear, is very painful, and reveals itself by bad **earache.** There will probably be persistent crying, rolling of the head from side to side, fever, and loss of appetite, and a tenderness just behind the ear. At this stage, hot fomentations and poultices may give relief. The doctor, who should always be sent for at once, will probably give a purge and perhaps use a leech behind the ear or a hot douche in the ear. Otitis generally goes on to the formation of pus or matter. This matter, being unable to get out, causes great pain, but in time it usually penetrates the drum of the ear, and appears outside as a thick, yellow discharge, often smelling very offensive. As soon as the mat-

ter appears the pain is generally relieved. The surgeon often anticipates the opening of the abscess by puncturing the drum membrane, and so saves the child a good deal of pain. The ear must now be kept very clean, and gently syringed several times a day with a warm solution of Condy's fluid or boric acid solution (1 per cent), after which it is well to gently insert a fresh piece of antiseptic wool.

Otitis is very liable to occur in the course of measles or scarlet fever, or during teething. Discharge from the ear should never be lightly looked upon or neglected. In spite of all care, deafness may ensue; and the inflammation may even spread to the brain, and cause death.

Convulsions.

These are usually one of the greatest horrors of a young mother. Nothing is more alarming than to see baby, who a few moments ago was looking the picture of health, suddenly turn blue and rigid, all the muscles twitch and become convulsed, the eyes turn up with a fixed, unconscious stare, while, to all appearance, in a few more seconds all will be over.

The first thing to do is to loosen the child's clothing, so that there may be nothing tight around the neck, and then to open the mouth by forcing the finger between the gums, so as to allow a free passage of air into the chest. In older children, a spoon or tooth brush can be used instead of the finger. A **hot bath** may then be given, the head being sponged with cold water at the same time. The usual duration of a fit is about one or two minutes, although they may last much longer. The child may die suffocated during the fit.

The commonest cause of convulsions is an **overloaded stomach**; in such cases an emetic is called for. Fits are far more common in rickety children than in healthy ones. **Constipation** or **worms** may also excite an attack. Childish ailments, e. g., measles or scarlet fever, are often ushered in by a fit: in some instances it is the first indication of an attack of inflammation of the brain, or of epilepsy. A doctor will usually be able to put his finger at once on the cause of the fit, and so prevent a recurrence.

The so-called **"inward convulsions,"** in which a young baby has blueness around the mouth and twitchings of the muscles of the face, with half-closed eyes, must not be confounded with true con-

vulsions, but are due to flatulence, and can easily be relieved by a little carbonate of soda in water, or by dill water or other similar remedy (see under "Medicines for Baby," next chapter).

Fig. 242. A 4-year-old child who was born with cretinism. Notice the enlarged tongue, belly and legs, and the stupid expression.

Fig. 243. The same child, after 4 months' treatment with extract of the thyroid gland. It is quite cured.

Infantile Paralysis.

This is a form of paralysis which is fairly common in children under four years old. The legs are usually affected, one or both, though more rarely the upper extremities suffer. The disease may begin with a fit or a feverish attack. In some cases, however, the child may go to bed apparently quite well, and in the morning be found to have complete paralysis of one or both legs. The disease is an inflammation of the spinal cord. The causes are usually stated to be exposure to heat or cold, and over-walking. But no way of preventing this unfortunate disease is known. The paralyzed part is quite helpless, but its sensation is perfect. After a few days, it is usual for the paralysis to get a little better, and for some amount of power to return. Wasting of the affected part sets in, so that it becomes much smaller than the other side: it is also cold and bluish. In bad cases the limb is utterly useless. Much can be done by patience and perseverance.

(1) **Clothing:** Always keep the limb warm, day and night. Have the child wear an extra stocking of thick wool, coming well above the knee.

(2) **Rubbing:** This should be done regularly, night and morning, for a quarter of an hour at a time, care being taken to always rub upwards, i. e., towards the body. But besides actual rubbing, the muscles should be kneaded, squeezed and shampooed. If the expense of a trained masseuse is prohibitive, it will be well for the mother or nurse to take some lessons in massage, in order to carry out this line of treatment. (See section on "Massage.")

(3) **Douching:** Which should be effected by pouring a large jug of hot water over the limb, followed by a jug of cold water, after which the limb should be rubbed dry with a fairly coarse towel, to produce a glow on the skin. Many use sea salt in the water.

(4) **Electricity:** This, after a few lessons, can be applied by the mother at home. An effective faradic battery can now be bought for about five dollars. Care should always be taken not to apply the current too strong or for too long a time at one sitting.

Progress will always be slow, and treatment must be carried out systematically, and for a long time. Probably the arm or leg will always be weak, and will get sooner tired than the sound one. A parent will be well rewarded for all the trouble if the limb remain only a little weak, instead of hanging as a useless flail, utterly incapable of doing any work at all.

In neglected cases the muscles contract, so that the tendons may require dividing, and the limb to be put into a surgical boot.

The paralysis itself never tends to get worse.

Rheumatism.

This disease is very apt to be overlooked, especially in young children, as the joint pains are often very slight, and are put down by the mother or nurse to "growing pains." The serious thing about rheumatism in young children is, that the heart is so very liable to become affected. Heart disease in children is always dangerous, and often fatal. St. Vitus' dance may follow an attack of rheumatism.

If a child complains of pains in its ankles, knees, or wrists, the best thing to do is to keep it warm in bed, and send for a doctor.

Inflammation of the covering of the heart (termed **pericarditis**) is usually accompanied by vomiting, breathlessless, fever and pain in the stomach.

Bad Habits of Children.

The most common bad habits of young children are **sucking, nail-biting, dirt-eating, bed-wetting** and **masturbation.**

Children **suck** their thumb, fingers, clothing, blanket, or a "comforter," "pacifier" or rubber nipple unwisely given for the purpose. The habit may begin in early infancy and last until the age of six or seven if not stopped. It is harmful in several ways, and should be prevented or broken up as soon as possible. Thus it may cause a displacement of the teeth and so disfigure the mouth; it may distort the fingers; it makes the saliva flow and is apt to increase the digestive disorders during which sucking is likely to be most practiced. It may cause thrush or other sore mouth. It is quite wrong to give a baby anything to suck, either to quiet or put him to sleep, and only serves to cause neglect of attention which the child should otherwise demand.

In dealing with the habit one should be very sure that the baby is not underfed and so sucks from hunger. Putting on mittens or fastening the hands to the sides during sleep may be necessary, or in very obstinate cases one may have to bandage cardboard on the arms so that the elbows cannot be bent to bring the hands to the mouth.

Nail-biting and **dirt-eating** are seen only in children over three, and are commonest in those with nervousness or poor health. The nervous disease may not show itself until later in life. The child must be closely watched and the bad habit surely broken up. An endeavor must be made too to find out if there is any disease as a cause.

Bed-wetting is quite natural until the age of two or two and a half, at which time a child should get control over the bladder at night, although some do not gain this until three years old. At three or four years of age it may be of use to punish the child, if the trouble is due to his carelessness or indifference. With older children, rewards are more successful, and punishments are of no use. The fault may be due to the mistake of giving too much to drink late in the day; the child should have plenty of milk early in the day, but no fluids after 4 p. m. The supper should be of solid or semi-solid food. At 10 o'clock the child should be taken up to

empty the bladder. The habit may be due to poor general health or to irritant urine, or to some irritation in the genital organs, such as adherent foreskin. If the simple means here advised do not succeed in curing, a physician should be consulted.

Masturbation is the habit of rubbing the genital organs with the hands or clothing, against the bed, or between the thighs. Or the child may sit on the floor and rock back and forth. The habit may be seen in both sexes and at any age, even under a year. Often these things are lightly passed over and regarded for months as "queer tricks." It is a most injurious habit and must be cured as early as possible. Children should be watched until they go asleep and again when they wake up until they are dressed.

INSTRUCTION FORTY-TWO—*Medicines*

Medicines for Infants and Children

These Should Be Kept Under Lock and Key and Every Bottle Properly Labeled.

Subject Reference

For Medicines and Prescriptions for Adults and Abbreviations used by physicians in writing Prescriptions, see Vol. 2, pages 588 to 634.

Medicines—Homœopathic Globules—Measure Glasses—Powders—Aconite—Alcohol—Bicarbonate of Soda—Borax—Bromide of Potassium—Calomel—Castor Oil—Chalk — Cod-liver Oil — Dill Water—Glycerine—Ipecacuanha—Magnesia—Malt—Manna—Opium—Rhubarb—Senna—Sulphur—Compresses—Embrocations—Ointments—Poultices.

The less medicine baby takes the better will it be. Baby's stomach was made for **food,** not for medicines. Many mothers seem to forget this, and are perpetually dosing their unfortunate children with aconite, teething powders, castor oil, etc. It is hardly to be wondered at that such infants are never really well; but it never appears to dawn upon the mother that the remedies employed are creating the very evils they are supposed to avert.

All medicines should be kept in a place by themselves, **under lock and key,** and **every bottle properly labeled.** Nothing is safe from a child, and to have medicines, liniments and ointments lying about in the bedroom or nursery is most dangerous, many a fatal accident having occurred through want of a little forethought in this matter.

Nurse should never be allowed to give any medicine to baby, no matter how simple, without the knowledge of the mother.

Medicines for children should always be given in as palatable a form as possible. For this reason parvules, tabloids, or granules (not homeopathic) are very convenient. The objection to giving homeopathic drugs is, that one never knows what one is giving; many of the globules contain nothing but sugar, whilst others, though really containing powerful drugs, do so in uncertain quantities, and are therefore dangerous.

The usual mistake that a mother makes is this. Baby is ill; the disease is diagnosed (often wrongly), and baby is dosed with medicines that effected a cure in the case of some neighbor's or friend's child. Sometimes a medical or homeopathic dictionary is consulted, and the child is treated with all rigor according to the directions given.

In either case **the child itself** has been utterly ignored. The **disease** has been treated, and not the **child.** Children differ greatly in their constitution and requirements. Two children, both ill with the same disease, may require exactly opposite treatment: the remedy that would save the one might kill the other. The great thing is to treat the **child,** not the **disease.**

Always carefully measure out in a proper medicine glass the quantity of any medicine required; to guess haphazard is often dangerous, and to use ordinary spoons for measurement is always unsatisfactory. It is well to have two measure glasses, one a measure for drops and the other for larger quantities.

The following table is approximately correct:

60 drops equal one drachm, or teaspoonful.
120 drops equal two drachms, or one dessertspoonful.
4 drachms equal half-an-ounce, or one tablespoonful.
8 drachms equal one ounce, or two tablespoonfuls.
20 ounces equal one pint.

The best way to give a powder is to moisten the tip of one's finger, and when all the powder has adhered to it, introduce it into the child's mouth, as far back as possible. If a powder be at all nasty, mix it with a little finely powdered loaf sugar.

We will now look at a few remedies about which every mother ought to know something, in case of emergency, but it cannot be too much insisted upon that the proper person to prescribe them is the doctor.

Aconite.—This is a most useful drug, and is often ordered in the treatment of the feverish attacks to which infants are so liable. When

a child is feverish, with a hot, dry skin, and quick pulse, aconite will often act as a charm, quickly reducing the fever, slowing the pulse, causing perspiration, and enabling the child to get off into a comfortable sleep. It is, however, a depressing drug, and should not be given without medical advice. It is a very powerful drug. The dose for a child is much smaller than for an adult (see Dose Table for Children). For an adult the dose is one drop in a dessert-spoonful of water every twenty minutes until the skin gets moist and the pulse soft (usually 5 to 10 doses). In this manner it is very useful in the beginning of acute bronchitis, tonsillitis, pleurisy, and other feverish states.

Alcohol.—In the form of brandy, alcohol is an invaluable medicine for babies, though of course it should only be used on an emergency. To give wine, spirits, or beer to a child, as a regular thing, or because it seems to like them, ought to be made a criminal offence.

Brandy is most useful in cases of collapse, e. g., after attacks of vomiting or diarrhea. The dose for a child of one month old would be ten drops every four or six hours, diluted with three or four times the quantity of water. The quantity may be increased according to age, till at three months twenty to thirty drops every four hours may be given just before food for a few doses. Mixing it with a bottle of food is useless, firstly, because it is too much diluted to do any good, and secondly, because the child being ill, will probably take only a few mouthfuls, in which case it practically gets no brandy at all. Children respond to brandy in any form of prostration better than to any other stimulant; it is also a useful sedative in the restlessness of teething.

Medicated wines, e. g., coca wine or beef and iron wine, should never be given to children, and when in severe cases of illness brandy is being administered, it should always be called and treated as medicine.

Bicarbonate of Soda, "Baking Soda" or "Soda."—This remedy is chiefly of use in cases of acidity and flatulence. It is conveniently put up in tabloids containing five grains each. One of these dissolved in a teaspoonful of dill water and added to two teaspoonfuls of hot water, is a capital remedy for an attack of "wind" in a child of six months old. As before mentioned, bicarbonate of soda can be used for neutralizing acidity of milk and a strong solution painted on a recent scald or burn quickly allays the pain. When a child's urine

scalds and makes it uncomfortable, a dose of bicarbonate of soda three times a day will usually put all right.

Borax.—One ounce of borax dissolved in four ounces of glycerine makes an excellent application for painting the mouth in cases of thrush. Mixed with six times its volume of water, the glycerine and borax mixture makes an efficient gargle for older children.

Bromide of Potassium.—This is a nerve sedative, and is often of great service during teething. It is also very useful for children who are excitable and nervous, and who talk and cry out in their sleep. Bromide acts as a depressant on the system, and should never be given as a regular thing for any length of time.

Calomel.—This is a preparation of mercury which was at one time very largely used in the diseases of infants, but through misuse and abuse has fallen into undeserved disrepute. If baby refuse its food, and the motions be clay-colored, hard and dry, a dose of calomel at bedtime is often ordered, and will generally work wonders. A better way to give calomel is in small repeated doses, e. g., 1-20 grain every half hour for 8 or 10 doses, or until the bowels move properly. It may be mixed with sugar of milk or just with powdered white sugar, of which, however, very little should be used at a time.

Cascara in the form of an elixir or syrup is a useful aperient in the chronic constipation of children, being given regularly for some time to act as an intestinal tonic. Once the regular action of the bowel is established, give one drop less of the medicine each night until it is no longer given. Thus, if 15 drops be necessary at first, the medicine will be discontinued in two weeks by reducing the dose a drop each time.

It may cause an acne, or pimples; and when to be given for some time, it should have arsenic combined with it to keep the skin clear.

Castor Oil is one of the most efficient aperients for an infant; it has, however, the disadvantage of being somewhat constipating afterwards. It is very good for carrying off any offending food and to quiet the bowel. The dose for a child of six months old is half a teaspoonful. A teaspoonful of olive oil is, however, in many instances, preferable to castor oil.

Chalk.—This drug is usually administered in the form of the aromatic powder ("aromatic chalk mixture"), and is useful in cases of diarrhea with acidity.

Cod-liver Oil is a **food** rather than a medicine. It may be employed in all wasting diseases, and given to children that are always having colds and coughs. Thin, delicate children are often

picked up and strengthened in a wonderfully short time by it. An infant of a few months old can easily be made to take the oil by sucking at a finger which has been previously dipped in the medicine. To a child a year old a teaspoonful may be given twice a day after food. It is a good plan to begin with a teaspoonful, once a day, going to bed. With older children the dose may be increased to a dessert-spoonful, which, if necessary, may be floated on milk, coffee, or orange wine. It is of no advantage to give larger doses of the oil; it will only repeat, and is not digested. Good extract of malt with cod-liver oil, and well-made emulsion of cod-liver oil, from a reliable firm, are excellent preparations and easily digested.

Children with the least suspicion of rickets should take cod-liver oil all the year round, except in very hot weather. It is also a good preventive of chilblains in older children. Some children who will refuse cod-liver oil will take a preparation of bone marrow rich in animal fat.

Dill Water.—Under this may also be considered, carraway, anise, and peppermint water, which are all good household remedies for the stomach-ache, colic, and flatulence. A teaspoonful, repeated occasionally if necessary, is the ordinary dose. An equal part of hot water added to the remedy, greatly enhances the effect.

Glycerine.—A teaspoonful in water at bedtime often makes a good aperient for a child. Of late it has been the fashion to use an injection of this drug into the lower bowel, a special syringe being made for the purpose; about a teaspoonful of glycerine is required, and it usually acts within five minutes. Suppositories containing glycerine are also employed, and are much less trouble. In quite young infants, the old remedy of introducing a small stick of soap into the anus is generally effective. It should be good castile, the size of half the little finger (¾ in. long by ½ thick), with rounded ends. Wet it and the anus for introduction.

Ipecacuanha.—This drug is usually given in the form of the ipecacuanha wine, or "wine of ipecac." In large doses it acts as an emetic, that for a child of a year old being one teaspoonful, repeated in fifteen minutes if necessary. In the treatment of croup it is often desirable to make a child vomit at once, and mothers, whose children are liable to that disease, would better keep a bottle of the wine in the house, so as to have it handy if required. It is often used in this way to clear the windpipe of phlegm in cases of bronchitis, or to empty the stomach in cases of over-feeding.

Ipecacuanha wine is not a drug that keeps well, and after some

months is apt to make a deposit at the bottom of the bottle, and lose its good qualities.

Magnesia.—Probably the less aperient medicine a child takes, the more regularly will its bowels act. As pointed out elsewhere, the chief remedy for constipation is a change in the diet.

Magnesia, in the form of the citrate, or of Dinneford's fluid magnesia, or Phillips's milk of magnesia, is a harmless aperient if only used occasionally and according to directions. In the summer weather, when a child gets easily upset, a dose of magnesia will often be very beneficial.

Malt.—There are several excellent preparations on the market, both with and without cod-liver oil, and children will readily take and digest them. They are especially indicated for thin children, with poor appetites and delicate digestions. Half a teaspoonful sucked from the finger or rubbed up with a little milk, will be greatly relished by an infant. For a child a year old a teaspoonful may be given twice a day.

Manna.—This is a very common household remedy for infantile constipation; a teaspoonful dissolved in the bottle acts very well with some infants. but it is very uncertain, and with others will have no effect at all. A dessert-spoonful of prune juice is often efficacious with infants under a year old.

Opium.—This drug should never be given to children under any circumstances whatever, except by a doctor's order. Infants tolerate opium very badly, and thousands of young lives have been sacrificed to it, administered in the form of Soothing Powders, Composing Mixtures, Quieting Syrups, Paregorics, etc. No mother should be tempted ever to use any of these in order to keep her baby quiet; they are poison, and should be avoided as such. A child who is always crying and sleepless cannot be well, and the mother would far better call in a doctor to point out what is wrong.

Two drops of laudanum have proved fatal to an infant, and a third of a grain of opium has killed a child of nine months.

Patent "soothing mixtures" are the cause of a great many of the inquests held upon children.

Rhubarb, though a very favorite household drug, is not to be recommended for children, since when given as an aperient it proves constipating afterwards. It is usually given as a powder, or in the form of the syrup.

Senna.—Syrup of senna, though a good aperient, causes too much griping for infants of tender years.

Sulphur, in the form of flowers of sulphur, or the confection, is often of use to get a child's bowels into a proper condition. It should not be given under two years of age.

External Remedies.

It will be useful in conclusion to briefly consider a few of the external remedies which are commonly employed.

Compresses.—A compress consists of several folds of soft linen or calico wrung out of water, and covered with a piece of oiled silk or mackintosh sufficiently large to overlap the linen on all sides. Compresses are either hot or cold, according to the temperature of the water used. They must be changed often, as a general rule, i. e., one is put on for 2 minutes and then replaced by another one which has been got ready in the meantime. Do not use hot and cold compresses together.

In some cases, compresses have a sedative effect, calming a child's nerves and inducing sleep. One applied to the abdomen will often relieve constipation, and over the throat will usually relieve sore throat.

Lotions.—Boracic lotion is a useful household remedy. It is good for bathing eyes which are inflamed from a cold, for cleansing little wounds such as those made by falling on gravel, and for applying on lint under oiled silk to gathered fingers. Evaporating lotion is made by mixing spirit, e. g., rectified spirit or Eau de Cologne, with four times its quantity of water. A single layer of linen or muslin can be dipped in this and laid on the forehead when a child is very feverish and restless, being changed as soon as it becomes dry. The same treatment is useful in the case of injury to a joint while waiting for the doctor.

Embrocations or **Liniments.**—In cases of cold on the chest, whooping cough, etc., it will often prove beneficial to rub the chest back and front, night and morning, with a simple liniment. An infant's skin is very easily irritated, so that no strong embrocation should be employed. Simple oil, camphorated oil, or a soap liniment diluted with oil, are about the best to use for this purpose. The rubbing should be performed with the child across the knees, in front of the fire.

Ointments.—Benzoated lard is one of the best ointments for nursery use in case of chafing, rough skin, or sores, but boracic or zinc ointments are also very useful. Pure vaseline is excellent.

Poultices.—These are much less used than formerly, but it is well to know how to make them properly. They act by their **moisture** and their **heat,** and probably affect the blood-vessels and the nerves to the part over which the poultice is applied. The material generally employed is freshly crushed linseed, or stale bread. The basin and knife should both be scalded in hot water, sufficient boiling water should then be put into the basin, and the meal gradually added, stirring all the time with the knife. The product should then be of the consistency of batter pudding, and be such that it can be easily spread on soft linen or old rag with the knife, to the thickness of about half an inch. The poultice should then be applied over a piece of clean linen or cotton placed next the bare skin, and covered with one or more layers of thick flannel. A poultice thus made will keep hot for two or three hours, at the end of which time it should be removed, and, if necessary, a new one applied. It is important to have the poultice **hot,** therefore it should be hot to begin with, should be large enough to keep hot some time (but not be too heavy) and should be changed at once as soon as it is no longer hot. Otherwise used a poultice is only harmful.

Of course a boiling-hot poultice should never be suddenly clapped on the tender skin of a child. Try the temperature of the poultice with the back of the hand, and then gently and gradually cover the required part.

Mustard may require to be added to the linseed; in which case it must be thoroughly mixed with the meal, or it will collect in one spot and produce a blister.

A poultice to cover the chest, which contains, say, a teaspoonful of mustard, should be partially removed after twenty minutes to see if the skin be sufficiently reddened. If so, remove it at once, or a large blister may occur before this danger is thought of.

After the removal of a poultice, the affected part should be covered with a layer of warmed cotton wool to prevent the child catching cold. On the chest the wool or poultice is best kept in place by means of a little flannel jersey.

A jacket poultice is one made to cover the entire chest, back and front, coming well up beneath the armpits, and retained in place by a safety pin over each shoulder.

A good method of employing heat to relieve pain is to half fill an indiarubber hot-water bottle with hot water, slip it into a flannel bag, and apply it to the painful part. The flannel covering may be made wet, thus giving the effect of a poultice.

How to bring up a baby in a rational and scientific manner has now been briefly described, and in following the **spirit** rather than the **letter** of the foregoing pages, it is believed that mothers and nurses will prove the truth and wisdom of them in their own experience—**experientia multa docet**—"Experience teaches many things!"

REFERENCE INDEX

(For Volume One Only)

For Further Inquiry or Subjects Not Given in this Index, Consult REFERENCE INDEX in Volume Two, Pages 691-703.

NOTE:—Attention is called to the Very Useful and Valuable Service Rendered to the Reader by the Practical Helps and Explanatory Guides in the Form of Subject References.

These will be found throughout this Series of Instructions at the Head of the Various Subjects.

Subject Reference.

For Meaning of Medical Words, see Dictionary of Medical Terms, Vol. 2, pages 681-689.
